PATENT ABSTRACTS OF JAPAN

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(54) BOTH-SIDE ASPHERICAL PROGRESSIVE REFRACTIVE POWER LENS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a both-side aspherical progressive refractive power lens capable of reducing the magnification difference between images at a farsighted part and a nearsighted part, satisfactorily correcting eyesight with reference to a prescription value, and imparting an effective wide visual field with less distortion when putting on.

SOLUTION: As for a 1st refractive surface on an object side surface, provided that a surface refractive power in a horizontal direction and the surface refractive power in the vertical direction at the farsighted degree measurement position F1 are expressed by DHf and DVf, respectively, and also, as for the 1st refractive surface, provided that the surface refractive power in a horizontal direction and the surface refractive power in the vertical direction at a nearsighted degree measurement position N1 are expressed by DHn and DVn, respectively, the following relational expressions are satisfied; DHf+DHn<DVf+DVn, and DHn<DVn, and also, the surface astigmatism component in the positions F1 and N1 on the 1st refractive surface are counterbalanced with the 2nd refractive surface on the eyeball side surface, and the farsighted degree (Df) and an addition degree (ADD) based on the prescription value are imparted with the combination of the 1st and 2nd refractive surfaces.

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CLAIMS

[Claim(s)]
[Claim 1] Are the double-sided aspheric surface mold progressive power lens which equipped the 1st refraction front face which is a body side front face, and the 2nd refraction front face which is an eyeball side front face with the progressive refractive-power operation by which division allocation is carried out, and it sets on said 1st refraction front face. Set surface refractive power of the longitudinal direction in the frequency measuring point F1 for **, and surface refractive power of a lengthwise direction to DHfDVf, and they are set on said 1st refraction front face, respectively. When setting surface refractive power of the longitudinal direction in the **** frequency measuring point N1, and surface refractive power of a lengthwise direction to DHnDVn, respectively, while satisfying the relational expression used as DHf+DHn<DVf+DVn and DHn<DVn The surface astigmatism component in F1 and N1 on said 1st front face of refraction on said 2nd refraction front face Phase murder, The double-sided aspheric surface mold progressive power lens characterized by doubling said the 1st and 2nd refraction front face, and giving the frequency for ** based on a formula value (Df), and subscription frequency (ADD).
[Claim 2] The double-sided aspheric surface mold progressive power lens according to claim 1 characterized by satisfying the relational expression used as DVn-DVf>ADD/2, and DHn-DHf<ADD/2.
[Claim 3] It is bilateral symmetry bordering on the one meridian where said 1st refraction front face passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface progressive power lens according to claim 1 or 2 which only a predetermined distance is brought near inside, is made into the nose side, and is characterized by supporting the convergence operation of the eye in near viewing.
[Claim 4] It is the surface of revolution where said 1st refraction front face used as the bus-bar the one meridian which passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface mold progressive power lens according to claim 1 to 3 which only a predetermined distance is brought near inside, is made into the nose side, and is characterized by supporting the convergence operation of the eye in near viewing.
[Claim 5] The double-sided aspheric surface mold progressive power lens according to claim 1 to 4 characterized by to reduce generating of astigmatism and the change of frequency resulting from the look and lens side in a wearing condition not intersecting perpendicularly when considering as the configuration which doubles said the 1st and 2nd refraction front face, and gives the frequency for ** based on a formula value (Df), and subscription frequency (ADD).

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is a lens used as for example, a progressive power lens for presbyopias for glasses. The 1st refraction front face which is a body side front face, and the 2nd refraction front face which is an eyeball side front face are equipped with the progressive refractive-power operation by which division allocation is carried out. It is related with the double-sided aspheric surface mold progressive power lens which has the composition of doubling said the 1st front face and said 2nd front face, and giving the frequency for ** based on a formula value (Df), and subscription frequency (ADD).
[0002]
[Description of the Prior Art] Though a progressive power lens is a spectacle lens for presbyopias, generally the appearance top is widely used from the reasons of the advantage which is not easily perceived as spectacles for the aged, the advantage which can carry out clear vision continuously [there is no break from a long distance to a short distance, and]. However, without making a borderline intervene into a limited lens area From the convenience which arranges two or more visual fields that the visual field for seeing a distant place and the method of Kon were called the visual field for seeing, and visual field for seeing those in-between distance further The thing which a fault peculiar to a progressive power lens is -- the size of each visual field not being necessarily enough and the field which impresses the distortion and the shake of an image mainly in the visual field of the side exist -- is also known widely.
[0003] Although proposals various for many years had been made in order to improve a fault peculiar to these progressive power lenses, the thing of combination which the field configuration of those conventional progressive power lenses allotted the "progressive side" to the body side front face, and allotted the "spherical surface" and a "astigmatism side" to the eyeball side front face was almost the case. Moreover, with these, there is Atoral Variplas put on the market from French country Essel Optical Co. (the present Essilor) in 1970 as a progressive power lens characterized by making reverse add "a progressive operation" to an eyeball side front face.
[0004] Moreover, as advanced technology proposed in recent years, ****** of a publication etc. is for example, in the patent international disclosure WO 97/No. 19382 and WO 97/No. 19383 official report, and, generally it is called rear-face successive promotion (or concave surface successive promotion) to them. The main objects of the field configuration in the rear-face successive promotion proposed in recent years [this] are making a part or all of required subscription frequency share with an eyeball side front face from a body side front face, tend to reduce the scale-factor difference of the image of a distance point and a reading point, and tend to improve the distortion and the shake of an image.
[0005] A thing given in WO 97/No. 19382 official report among these advanced technology All "progressive operations" is blot out by making a body side front face into the spherical surface or the symmetry-of-revolution aspheric surface. The "progressive side" which gives predetermined subscription frequency only to an eyeball side front face is made to add (fusion). Moreover, a thing

given in WO 97/No. 19383 official report The subscription frequency in the "progressive side" of a body side front face is made fewer than a predetermined value, and it has composition in which the "progressive side" which gives the subscription frequency of an insufficiency was made to add to the "spherical surface" and the "astigmatism side" by the side of a rear face (fusion).
[0006] Moreover, although a difference is one of the object or antecedent bases As other advanced technology of a progressive power lens with the publication to which "the progressive operation" was made to add to an eyeball side front face For example, JP,47-23943,B, JP,57-10112,A, As advanced technology which there is a thing of a publication etc. in JP,10-206805,A, JP,2000-21846,A, etc., and gave "the progressive operation" to the further above-mentioned WO 97/No. 19383 official report to both sides of a lens like the thing of a publication For example, there are JP,2000-338452,A and a thing given in JP,6-118353,A. The common feature of these advanced technology is the 2nd page of a front flesh side having shared required subscription frequency, and having given it.
[0007]
[Problem(s) to be Solved by the Invention] The main objects of these advanced technology are making a part or all of required subscription frequency share with an eyeball side front face from a body side front face, tend to reduce the scale-factor difference of a distance point and a reading point, and tend to improve the distortion and the shake of an image by the scale-factor difference. However, about the antecedent basis from which those improvement effects are acquired, there are few clear publications and there is a partial publication in said patent international disclosure WO 97/No. 19383 official report (henceforth the conventional technique 1) etc. slightly. That is, the formula of the lens scale factor SM shown in the following (1) equation - (3) equations is indicated by the conventional technique 1, and it is adopted as it as a basic assessment parameter of a lens design.
[0008] That is, the conventional technique 1 has the following publications. "Generally the scale factor SM of a lens is expressed with the following formula.
SM=MpxMs -- (1)
Here, Mp is called a power factor and Ms is called a shape factor. When the base curve (refractive power) of the field by the side of n and the body of a lens is set [the distance from the top-most vertices (inside top-most vertices) of the field by the side of the eyeball of a lens to an eyeball / the refractive power (inside vertex diopter) of the distance L between the tops, and inside top-most vertices / the thickness of the core of Po and a lens] to Pb for the refractive index of t and a lens, it is expressed as follows.
Mp=1/(1-LxPo) -- (2)
Ms=1/(1-(txPb)/n) -- (3)
In addition, in a formula (2) and count of (3), distance L and thickness are used about a base curve Pb, and a meter (m) is used [the inside vertex diopter Po] for diopter (D) about t, respectively. "
[0009] And the difference of the scale factor of a distance point and a reading point is computed using the formula of these lens scale factors SM, and with the conventional technique 1, since there are few the scale-factor differences, it is supposed that the distortion and the shake of an image are improved.
[0010] According to research of an invention-in-this-application person, although fixed effectiveness was accepted in the above-mentioned conventional technique 1 as compared with the advanced technology, in order to perform the lens design of high performance more, it became clear that there was the need of examining the following points further.
a. So that clearly also from the publication "the distance L from the top-most vertices of the field by the side of the eyeball of a lens to an eyeball", and "thickness [of the core of a lens] t", properly speaking, the parameter which should be applied only [near the center of a lens] is contained in the basic assessment parameter used with the above-mentioned conventional technique 1. That is, in the example of the conventional technique 1, since the basic assessment parameter which should be applied only to the distance point near the center of a lens will be applied from the lens core also to the reading point located caudad greatly, the possibility of the error by it remains.
[0011] b. With the conventional technique 1, the scale factor SM of a lens is computed with five basic assessment parameters which applied the "refractive index n of a lens" other than the above. However, if

the lens to which frequency was attached actually is leaned forward and backward, it will be thought that the magnitude of an image is strongly influenced at "the include angle of a look and a lens side" so that it may understand immediately. Therefore, by calculation of the scale factor of a reading point greatly located caudad especially from a lens core, it is thought that this "include angle of a look and a lens side" cannot be disregarded. Therefore, it has the possibility of the error by what "the scale factor of a lens is computed for, without taking into consideration the include angle of a look and a lens side" for the lens design of the conventional technique 1.

[0012] c. Since there is no concept of a direction in the "scale factor" in the conventional technique 1 in addition to the publication of the application to an astigmatism lens, when [which occurs in the reading point located caudad greatly from a lens core, for example] "The scale factors of a lengthwise direction and a longitudinal direction differ" is said, the possibility of the error by this arises.

[0013] d. In order to perform scale-factor count to a reading point to accuracy, the distance to a target, i.e., the "pair object distance", must be added as a count factor, but since it is not taken into consideration about this "pair object distance" with the conventional technique 1, the possibility of the error by it cannot be denied, either.

e. In scale-factor count, since the effect by prism operation is not taken into consideration, there is possibility of the error by this. Thus, especially the conventional technique has the possibility which is not necessarily enough for accuracy from a view of computing a "scale factor" more.

[0014] by be make in order to solve this technical problem, and compute the scale factor of an image correctly in consideration of the effect by "the include angle of a look and a lens side", and the "pair object distance", this invention reduce the scale factor difference of the image in a distance point and a reading point, and set it as the offer - double-sided aspheric surface mold progressive power lens which give wide range effective visual field with little good eyesight amendment [to a formula value] and the distortion at time of wearing object.

[0015] furthermore, the right and left corresponding to a convergence operation of an eye [in / using "the semifinished product of bilateral symmetry" as a body side front face / only for an eyeball side front face / to after an award / near viewing] -- it aims at offering the double-sided aspheric surface mold progressive power lens which makes it possible to process it as an unsymmetrical curved surface, and makes it possible to reduce floor to floor time and cost.

[0016]

[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, the 1st means Are the double-sided aspheric surface mold progressive power lens which equipped the 1st refraction front face which is a body side front face, and the 2nd refraction front face which is an eyeball side front face with the progressive refractive-power operation by which division allocation is carried out, and it sets on said 1st refraction front face. Set surface refractive power of the longitudinal direction in the frequency measuring point F1 for **, and surface refractive power of a lengthwise direction to DHfDVf, and they are set on said 1st refraction front face, respectively. When setting surface refractive power of the longitudinal direction in the **** frequency measuring point N1, and surface refractive power of a lengthwise direction to DHnDVn, respectively, while satisfying the relational expression used as DHf+DHn<DVf+DVn and DHn<DVn The surface astigmatism component in F1 and N1 on said 1st front face of refraction on said 2nd refraction front face Phase murder, It is the double-sided aspheric surface mold progressive power lens characterized by doubling said the 1st and 2nd refraction front face, and giving the frequency for ** based on a formula value (Df), and subscription frequency (ADD). The 2nd means is a double-sided aspheric surface mold progressive power lens concerning the 1st means characterized by satisfying the relational expression used as DVn-DVf>ADD/2, and DHn-DHf<ADD/2. The 3rd means is bilateral symmetry bordering on the one meridian where said 1st refraction front face passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface progressive power lens concerning the 1st or 2nd means characterized by bringing near only a predetermined

distance inside, making it into the nose side, and supporting the convergence operation of the eye in near viewing. The 4th means is the surface of revolution where said 1st refraction front face used as the bus-bar the one meridian which passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface mold progressive power lens given in the 1st which only a predetermined distance is brought near inside, is made into the nose side, and is characterized by supporting the convergence operation of the eye in near viewing - the 3rd either. When considering as the configuration which doubles said the 1st and 2nd refraction front face, and gives the frequency for ** based on a formula value (Df), and subscription frequency (ADD), the 5th means it is the 1- characterized by reducing generating of astigmatism and the change of frequency resulting from the look and lens side in a wearing condition not intersecting perpendicularly -- it is a double-sided aspheric surface mold progressive power lens concerning one means of 4.

[0017] An above-mentioned means is thought out based on the following break-through results. Hereafter, it explains, making a drawing reference. The explanatory view of various kinds of surface refractive power [in / in drawing 1 / each location on the front face of a spectacle lens], Drawing 2 The explanatory view of the physical relationship of an eyeball, a look, and a lens, In drawing 31, drawing 32, and the drawing 33 list The explanatory view about the difference in the scale factor at the time of drawing 41, drawing 42, and drawing 43 being the explanatory views about the scale factor of M gamma of prism, and watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens, The front view which drawing 51 is the explanatory view of the optical layout of a progressive power lens, and looked at the progressive power lens from the body side front face, Drawing 52 is the explanatory view of the optical layout of a progressive power lens, and the side elevation showing the cross section of a lengthwise direction, the elevation which drawing 53 is the explanatory view of the optical layout of a progressive power lens, and expresses a lateral cross section, and drawing 6 are the explanatory views showing the difference in the definition of "subscription frequency." In addition, in these drawings, in Sign F, the frequency measuring point for ** and N show the frequency measuring point for Kon, and Q shows a prism frequency measuring point. Moreover, other signs described in drawing 1 etc. express the surface refractive power in N of the longitudinal direction profile curve which passes along surface refractive-power DHn:N in F of the longitudinal direction profile curve which passes along surface refractive-power DHf:F in N of the lengthwise direction profile curve which passes along surface refractive-power DVn:N in F of the lengthwise direction profile curve which passes along DVf:F. Furthermore, when the refraction front face of drawing is the 1st refraction front face which is a body side front face, a subscript 1 is given to all signs, and in being the 2nd refraction front face which is an eyeball side front face, it attaches and identifies a subscript 2 to all signs.

[0018] Moreover, as for N1 and N2, signs F1 and F2 show the number measuring point of the Kon supplies of a body side front face and an eyeball side front face to the frequency measuring point for ** of a body side front face and an eyeball side front face, and this appearance. Furthermore, the E's S centering on C reference [an eyeball and C considered as the winding central point of an eyeball and]-spherical surface, and Lf and Ln are looks which pass along the frequency measuring point for **, and the number measuring point of the Kon supplies, respectively. Moreover, M is a curve which the look when carrying out a binocular vision from the transverse-plane upper part to a lower part passes and which is called the main gaze line. And F1, N1, F2, N2, and N3 show the part to which opening of the lens meter which changes with definitions of "subscription frequency" is applied.

[0019] First, it asked for the formula of the scale factor corresponding to the reading point improved the thing which is the technical problem of (a) of the above-mentioned conventional technique, and "which you make a parameter correspond to a reading point", and "by taking the pair object distance into consideration" as follows. [which are the technical problem of (d)] That is, when Mp is made into a power factor and Ms is made into a shape factor, the scale factor SM of an image is SM=MpxMs. -- (1')

It is come out and expressed. Object power (inverse number of the pair object distance expressed with m unit) to a target is set to Px here. Refractive power [in / for the distance from the field by the side of the eyeball in the reading point of a lens to an eyeball / L and a reading point] (inside vertex diopter in a reading point) Po, The following relation will be materialized if the base curve (refractive power) of the field by the side of a body [in / for the refractive index of t and a lens / in the thickness in the reading point of a lens / the reading point of n and a lens] is set to Pb.
Mp=(1-(L+t) Px)/(1-LxPo) -- (2')
Ms=1/(1-tx(Px+Pb)/n) -- (3')
[0020] In these formulas, if each parameter is made to correspond to a distance point and 0 corresponding to infinite distance is substituted to Px which is the power display of the pair object distance, it is in agreement with the formula of the above-mentioned conventional technique 1. That is, it is thought that the formula used in the conventional technique 1 was a formula only for far viewing which is the pair object distance of infinite distance. Now, although (1') is the same as that of the formula of the above-mentioned conventional technique 1, since the pair object distance of near viewing is generally about 0.3m-0.4m, Px which is the inverse number serves as an about [-2.5--3.0] value here. Therefore, since the molecule of (2') increases, Mp increases, and in (3'), since a denominator increases, Ms decreases. That is, it turns out that the effect of the shape factor Ms in near viewing is fewer than count of the conventional technique 1. For example, it turns out that it is set to Ms=1 when the base curve (refractive power) of the field by the side of Pb=-Px, i.e., the body of a lens, is the value which is +2.5 to about +3.0, and it becomes completely unrelated [the shape factor in near viewing] to the scale factor of an image.
[0021] Now, each parameter is made to correspond to a reading point as mentioned above, and although it was able to ask for the formula in consideration of the "pair object distance" of a scale factor, in order to compute the scale factor in actual near viewing, it must take into consideration also about "the include angle of a look and a lens side" which is the technical problem of (b) of said conventional technique 1 further. I hear that there is directivity in "the include angle of a look and a lens side", and an important thing is in it here. That is, taking into consideration "the include angle of a look and a lens side" is exactly taking into consideration simultaneously the directivity of "the scale factor of an image" which is the technical problem of (c) of said conventional technique 1.
[0022] When the 1st formula of above-mentioned - (1') (3') is improved in this viewpoint, there is a base curve (refractive power) Pb of the field by the side of the body in the inside vertex diopter Po in a reading point and a reading point as a count factor which "the include angle of a look and a lens side" influences. Inside vertex diopter of the lengthwise direction in a reading point when the approximation of Martin which set the angle of a look [in / for the angle of the look in near viewing and the optical axis of a reading point field to make / alpha and near viewing] and the normal of the body side front face in a reading point to make to beta, and was known well here is used :P ov=Pox (1+Sin2alphax4/3)
Inside vertex diopter of the longitudinal direction in a reading point :P oh=Pox (1+Sin2alphax1/3)
Longitudinal-section refractive power of the body side front face in a reading point :P bv=Pbx (1+Sin2betax4/3)
Cross-section refractive power of the body side front face in a reading point :P bh=Pbx (1+Sin2betax1/3)
It becomes. Thus, unless angle alpha, beta and Po, and Pb are zero, refractive power, a power factor, a shape factor, etc. serve as a value which is in every direction and is different, consequently a difference produces them for the scale factor of a lengthwise direction and a longitudinal direction.
[0023] Now, although the approximation was used in order to explain briefly what here, "refractive power changes according to the direction of a look", it is desirable to calculate these values by strict ray-tracing count in a actual optical design. The optical path which met the look, using a Snell's law as a non-limiting example of these count approaches is calculated. By computing the distance from L, t, and a body side refracting interface to the object point, next using the 1st ground form in differential geometry, the 2nd ground form, the formula of Weingarten, etc. in accordance with this optical path The refractive power which took the effect of the refraction on the optical path in a body side refracting

interface and an eyeball side refracting interface into consideration is calculable. These formulas and count approaches are well-known very for many years, for example, since it is indicated by well-known reference "differential geometry" (Asakura Publishing Co., Ltd. issuance first edition 1949 written by Kentaro Yano) etc., explanation is omitted.
[0024] Now, the consideration about four count factors of L, Po, t, and Pb which are the technical problem of above-mentioned (a) - (d) is also made by performing ray-tracing count strict in this way, and, of course, the strict scale-factor count of the reading point greatly located caudad from a lens core is attained in all the directions of a look. Thus, the above-mentioned item, the inside vertex diopter of the lengthwise direction in a reading point :P Inside vertex diopter of the longitudinal direction in ov reading point :P Longitudinal-section refractive power of the body side front face in oh reading point :P Cross-section refractive power of the body side front face in bv reading point :P About bh, it asks [rather than] in a still higher precision using the approximation of Martin.
[0025] Thus, what should also be made to correspond to the difference in the direction of a look altogether will be easily understood also about scale-factor count of the above-mentioned image from what "refractive power changes according to the direction of a look." Here, Mp is made into a power factor, Ms is made into a shape factor, and if the subscript of h is attached and expressed [longitudinal direction / v and] about a lengthwise direction, the formula of above-mentioned - (1') (3') will be rewritten as follows about the scale factor SM of an image.
SMv=MpvxMsv -- (1v')
SMh=MphxMsh -- (1h')
Mpv=(1-(L+t) Px)/(1-LxPov) -- (2v')
Mph=(1-(L+t) Px)/(1-LxPoh) -- (2h')
Msv=1/(1-tx(Px+Pbv)/n) -- (3v')
Msh=1/(1-tx(Px+Pbh)/n) -- (3h')
[0026] The technical problem from (a) of said conventional technique 1 to (d) was able to be coped with as mentioned above. "The effect by prism operation" which is the above-mentioned technical problem of (e) when computing the scale factor in actual near viewing at the end is described. Although refractive power like a lens does not exist in the prism itself, the scale factor of M gamma of prism changes with whenever [incident angle / of the beam of light to prism], or outgoing radiation include angles. Here, the angular magnification gamma in case the beam of light which carried out incidence into the medium of a refractive index n out of the vacuum is refracted on a medium front face is considered like the left of drawing 31 and drawing 41. Snell law well known when the incident angle at this time was set to i and angle of refraction was set to r It is n=Sin i/Sin r. Moreover, the angular magnification gamma by refraction is expressed with gamma=Cos i/Cos r. Since it is n>=1, generally it is i>=r. It becomes and is set to gamma<=1. It is the case of i=r=0, i.e., vertical incidence, that gamma becomes maximum 1 here. Moreover, angle of refraction r When set to n= 1-/Sin r, gamma is the theoretical minimum value. gamma= 0 It becomes. this time -- i=pi/2 it is -- r is equal to the critical angle of total reflection in case a beam of light comes out out of a medium.
[0027] On the other hand, angular-magnification gamma' in case a beam of light comes out from the medium of a refractive index n into a vacuum completely becomes reverse with the above like the right of drawing 31 and drawing 41. That is, about an incident angle in case it is refracted on a medium front face from the interior of a medium and a beam of light comes out into a vacuum, i' and when angle of refraction is made into r', it is Snell law. It becomes 1-/n=Sin i'/Sin r' and angular magnification is expressed with gamma'=Cos i'/Cos r'. Since it is n>=1, generally it becomes r'>=i', and it is gamma'>=1. It becomes. gamma' becomes the minimum value 1 here. It is the case of i'=r'=0, i.e., vertical incidence. Moreover, gamma' is theoretical maximum when incident angle i' turns into n= 1-/Sin i'. It becomes gamma'=infinity. At this time, it is r'=pi/2, and i' is equal to the critical angle of total reflection in case a beam of light comes out out of a medium.
[0028] Like drawing 33 and drawing 43, the case where the beam of light which carried out incidence to the body side front face of one spectacle lens passes through the interior of a lens, carries out outgoing radiation from an eyeball side front face, and reaches an eyeball is considered (suppose henceforth that

the 1 [same] as the inside of a vacuum is resembled, and the refractive index of air is thought in simple for simplification of explanation.). If angle of refraction of i' and the beam of light which carried out outgoing radiation is made into r', the incident angle of the beam of light which set to i the incident angle of the beam of light which carried out incidence of the refractive index of a spectacle lens to n and a body side front face, set angle of refraction to r, and arrived at the eyeball side front face from the interior of a lens The angular magnification of M gamma which penetrated two front faces of a spectacle lens is expressed with the product of two kinds of above-mentioned angular magnification, and becomes Mgamma=gammaxgamma'=(Cos ixCos i')/(Cos rxCos r'). This is unrelated to the refractive power on the front face of a lens, and is known as a scale factor of prism.

[0029] Here, they are i=r' and r=i' like drawing 31 and drawing 41. Considering a case, it will be set to Mgamma=gammaxgamma'=1 and there will be no change in the scale factor of the image seen through prism. However, when a beam of light carries out incidence at right angles to the body side front face of a spectacle lens like drawing 32, it is set to Mgamma=gamma'=Cos i'/Cos r'>=1, and it is set to Mgamma=gamma=Cos i/Cos r<=1 when a beam of light carries out vertical outgoing radiation to reverse from the eyeball side front face of a spectacle lens like drawing 42.

[0030] Here, I hear that there is directivity in the scale factor of Mgamma of these prism, and an important thing is in it. That is, although considering distribution of the prism in a progressive power lens it naturally changes with frequency or formula prism values, there is little prism in the far viewing generally near the center of a lens, and the prism of the lengthwise direction in the near viewing located under the lens is large. Therefore, the scale factor of M gamma of prism can be said for effect to be large especially to the lengthwise direction of near viewing.

[0031] Now, it is closer to the configuration of drawing 32 which is Mgamma>=1 than drawing 31 which is Mgamma=1, and the near viewing of the progressive power lens in which a reading point has forward refractive power as not only a progressive power lens but the spectacle lens is carrying out the meniscus configuration whose body side front face is generally a convex, and whose eyeball side front face is concave, and it is shown in drawing 33, when it takes into consideration that the look in near viewing is downward is Mgamma>1 at least. It can say. Similarly, it is closer to the configuration of drawing 42 which is Mgamma<=1 than drawing 41 which is Mgamma=1, and the near viewing of the progressive power lens in which a reading point has negative refractive power as shown in drawing 43 is Mgamma<1 at least. It can say. therefore -- the near viewing of a progressive power lens by which a reading point has forward refractive power -- Mgamma>1 it is -- the near viewing of a progressive power lens by which a reading point has negative refractive power -- Mgamma<1 It becomes.

[0032] Like the above-mentioned, to being grasped only as a product of a power factor Mp and a shape factor Ms, the scale factor SM of the lens in said conventional technique 1 tends to multiply the scale factor of M gamma of prism further, and tends to obtain the scale factor of a right lens by this invention.

[0033] The scale factor of M gamma by this prism will be called a "prism factor" from comparison with Mp or Ms, and if the subscript of h is attached and expressed [longitudinal direction / v and] about a lengthwise direction, the formula of the above-mentioned (1v') and (1h') will be rewritten as follows about the scale factor SM of an image.

SMv=MpvxMsvxMgammav -- (1v")

SMh=MphxMshxMgammah -- (1h")

In addition, these Mgammav and Mgammah can be set and calculated like the count fault of the above-mentioned strict ray tracing. Thereby, the technical problem of the effect by the prism operation in scale-factor count of the above-mentioned glasses was solvable.

[0034] Now, in the usual convex progressive power lens, the surface refractive power of the "progressive side" of a body side front face serves as a distance point < reading point. On the other hand, at the progressive power lens of said conventional technique 1, it is going to improve the distortion and the shake of the image of a progressive power lens by changing the rate of a far and near shape factor, and decreasing the scale-factor difference of a far and near image by using surface refractive power of the "progressive side" of a body side front face as a distance point = reading point etc. However, although the advantage that the scale-factor difference of the far and near image about a longitudinal

direction decreased by lessening the far and near surface refractive-power difference of the "progressive side" of a body side front face arose in the consideration in the invention in this application, it turned out about the lengthwise direction that there are some problems in lessening a surface refractive-power difference.

[0035] The 1st problem is the effect of the prism factor Mgammav of a lengthwise direction. the case where are Mgammav<1 when the prism factor Mgammav of a lengthwise direction has negative refractive power like the above-mentioned, and it has forward refractive power -- Mgammav>1 although it becomes, the inclination is strengthened by lessening the surface refractive-power difference of a lengthwise direction -- having -- the frequency of a reading point -- positive/negative -- also when it is any, it separates from Mgammav=1 which is the scale factor of the naked eye. However, there is such no effect in the lateral prism factor Mgammah, and it is still Mgammah=1. A difference in every direction arises from the result, especially a reading point for the scale factor of the image covered caudad, and if some which should be essentially visible to a square are in plus frequency and are in minus frequency longwise, the inconvenience of looking oblong arises.

[0036] The 2nd problem is a problem which occurs only when especially the lengthwise direction of a reading point has forward refractive power. By lessening the surface refractive-power difference of a lengthwise direction, the inconvenience that the include angle of the look and lens side in near viewing serves as slant further, the power factor Mpv of the above-mentioned lengthwise direction increases, the scale factor SMv of a lengthwise direction will increase and the scale-factor difference of a far and near image will increase on the contrary by acting on the buildup and the duplex of the prism factor Mgammav of a lengthwise direction which were the 1st problem produces it.

[0037] That is, although lessening the far and near surface refractive-power difference of the progressive side which is a body side front face had an advantage about the longitudinal direction, about the lengthwise direction, it became clear that it was deteriorated on the contrary. Therefore, in the convex progressive power lens of a conventional type, the progressive side which is a body side front face can be divided into a lengthwise direction and a longitudinal direction, and the above-mentioned problem can be avoided by lessening a far and near surface refractive-power difference only about a longitudinal direction.

[0038] As stated above, the biggest description of the invention in this application is to define the assignment ratio of the 2nd page of the optimal front flesh side to each direction, and constitute the double-sided aspheric surface mold progressive power lens of one sheet about the progressive operation of a progressive power lens, after dividing into the lengthwise direction and longitudinal direction of a lens. For example, as an extreme example, all progressive operations of a lengthwise direction are given on a body side front face, and it is also the criteria of the invention in this application to give all lateral progressive operations on an eyeball side front face. In this case, all, only on one side, since the 2nd page of the front flesh side of a lens does not function as a usual progressive side, it cannot specify the subscription frequency as a progressive side. namely, a front flesh side -- any field serves as a progressive power lens which is not a progressive side. On the other hand, a difference assigns the "value" of required subscription frequency to the 2nd page of a front flesh side for all of a certain thing at an assignment ratio, and the above-mentioned various advanced technology constitutes the synthetic field with an astigmatism side etc. if needed, after assuming the substantial progressive side which gives each subscription frequency. That is, the point that the invention in this application differs on the above-mentioned advanced technology and an above-mentioned decision target is to constitute the double-sided aspheric surface mold progressive power lens which used for both sides the aspheric surface with the progressive operation which changes with directions.

[0039]

[Embodiment of the Invention] Hereafter, the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation of the invention in this application is explained. In addition, the following explanation explains the design approach used in order to obtain the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation first, and, subsequently to the gestalt of operation, explains the double-sided aspheric surface successive

promotion dioptric lens to apply.
[0040] (Procedure of a lens design) The outline procedure of the optical design approach of the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation is as follows.
** Below the rear-face amendment accompanying changeover in the convex configuration of the double-sided design ** invention in this application as a setting-out ** convex progressive power lens of input, a rear-face amendment ** transparency design, a design corresponding to a listing rule accompanying it, etc., decompose into a still finer step and explain each procedure in full detail.
[0041] ** The setting-out input of input is divided roughly into the two following kinds (it omits except an optical design).
** -1 : it is data of a proper at an item proper information lens item. The refractive index Ne of a raw material, minimum core thick CTmin, the minimum KOBA thickness ETmin, a progressive side design parameter, etc.
** -2 : the frequencies for wearing person proper ****** (prism the base the spherical-surface frequency S, the astigmatism frequency C, the astigmatism shaft AX, the prism frequency P, direction PAX, etc.), the subscription frequency ADD, frame configuration data (three-dimension configuration data are desirable), frame wearing data (an anteversion angle, gate angle, etc.), the distance between top-most vertices, layout data (PD for **, CD for Kon, eye point location, etc.), other data about an eyeball, etc. In addition, it brings near in the progressive band length and subscription frequency measuring method which are specified by the wearing person, and a reading point, and progressive side design parameters, such as an amount, are classified into wearing person proper information.
[0042] ** Divide and design on a convex and a concave surface as a convex progressive power lens of a conventional type at the double-sided design beginning as a convex progressive power lens.
** -1 : in order to realize the subscription frequency ADD and progressive band length which were given as convex configuration (convex successive promotion side) design input, design the field configuration of convex successive promotion of a conventional type according to the progressive side design parameter which is input. In the design in this step, it is possible to use conventional various well-known techniques, and the engineering of the invention in this application does not need.
[0043] There is a method of setting up the "prime meridian" equivalent to the backbone at the time of considering as the example of this approach, for example, constituting a lens side first. As for this "prime meridian", it is eventually desirable to consider as the "main gaze line" which hits the nodal line of a look when a glasses wearing person does a binocular vision from the transverse-plane upper part (distant place) to a lower part (method of Kon), and a lens side. however, the inside of the method field of Kon corresponding to a convergence operation of the eye in near viewing -- bringing near -- etc. -- it is not necessary to bring near a response among this "main gaze line", and to necessarily perform it by arrangement so that it may mention later Therefore, a "main gaze line" here passes through the center of a lens, and defines it as the one meridian (prime meridian) of the lengthwise direction which divides a lens side into right and left. Since there is a lens the 2nd page of a front flesh side, this "prime meridian" will exist two front flesh sides. When it looks at this "prime meridian" vertically to a lens side, it is visible in the shape of a straight line, but when a lens side is a curved surface, generally it becomes a curve in three-dimension space.
[0044] Next, the suitable refractive-power distribution along this "prime meridian" is set up based on information, such as predetermined subscription frequency and the die length of a progressive band. Although this refractive-power distribution can also carry out division setting out at the 2nd page of a front flesh side in consideration of the effect of the thickness of a lens, the include angle of a look and a refracting interface, etc., since the field configuration of convex successive promotion of a conventional type is designed, by the design in this step, all progressive operations shall be shown in the 1st refraction front face which is a body side front face. therefore -- for example, -- if transparency refractive power acquired is set to D when surface refractive power of the front face (1st refraction front face which is a body side front face) of a lens is set to D1 and surface refractive power of the rear face (2nd refraction front face which is an eyeball side front face) of a lens is set to D2 -- general -- It can ask in

approximation as D**D1-D2. However, a body side front face is a convex and, as for the combination of D1 and D2, it is desirable that it is the meniscus configuration whose eyeball side front face is concave. Here, please care about that D2 is a forward value. Usually, although the rear face of a lens is a concave surface and serves as a negative value as surface refractive power, on these descriptions, it considers as a forward value for the simplification of explanation, and it subtracts from D1 and suppose transparency refractive power that D is computed.

[0045] Dn=(N-1)/R generally defined by the following formula about relational expression with the shape of this surface refractive power and surface type -- here -- Dn: They are the refractive index of the surface refractive power (unit: diopter) of the n-th page, and N:lens raw material, and R:radius of curvature (unit: m). Therefore, 1/R= Dn/(N-1) which transformed the above-mentioned relational expression is used for the approach of converting distribution of surface refractive power into distribution of curvature. It means that the geometry of a "prime meridian" is decided uniquely and the "prime meridian" equivalent to the backbone at the time of constituting a lens side was set up by having acquired distribution of curvature.

[0046] Next, "the horizontal profile curve group" equivalent to the rib at the time of constituting a lens side is needed. Although there is no need that the include angle which these "horizontal profile curve groups" and "prime meridians" cross is not necessarily right-angled, in order to simplify explanation, each "horizontal profile curve" shall cross a right angle on a "prime meridian" here. Furthermore, "the lateral surface refractive power" of "the horizontal profile curve group" in an intersection with a "prime meridian" does not necessarily need to be equal to "the surface refractive power of a lengthwise direction" along a "prime meridian", and actually, as a claim has a publication, the invention in this application is based on the difference in the surface refractive power about a lengthwise direction and a longitudinal direction. However, in the design in this step, since the field configuration of convex successive promotion of a conventional type is designed, let surface refractive power of a lengthwise direction and a longitudinal direction in these intersections be an equal.

[0047] Now, although all "horizontal profile curves" can also be made into the simple circular curve which has the surface refractive power in these intersections, application incorporating various conventional techniques is also possible. There is a technique of JP,49-3595,B as a conventional technical example about the surface refractive-power distribution in alignment with "a horizontal profile curve." It is characterized by having the surface refractive-power distribution which increases applying this near the center of a lens and applying to the side one profile curve which sets up "the horizontal profile curve" of a circular configuration mostly, and is located more nearly up than it from a center, and the profile curve located caudad having the surface refractive-power distribution which is missing from the side and decreases from a center. Thus, a "prime meridian" and "the horizontal profile curve group" innumerably located in a line on it will constitute a lens side like the backbone and a rib, and a refracting interface is decided.

[0048] ** -2 : in order to realize the frequency for ** given as concave surface configuration (spherical-surface or astigmatism side) design input, design a concave surface configuration. If astigmatism frequency is in the frequency for **, it will become an astigmatism side, and it will become the spherical surface if there is nothing. At this time, the tilt angle between fields of core thick CT and the convex suitable for frequency, and a concave surface is also designed simultaneously, and the configuration as a lens is decided. The design in this step can also use conventional various well-known techniques, and the engineering of the invention in this application does not need it.

[0049] ** Convert into the configuration as a lens of the invention in this application from the convex progressive power lens of a conventional type according to frequency for **, the subscription frequency ADD, etc. accompanying changeover in the convex configuration of the invention in this application, and it which were given as rear-face amendment input.

** -1 : convert into the convex configuration of the invention in this application from the convex successive promotion side of a conventional type according to frequency for **, the subscription frequency ADD, etc. which were given as convex configuration (invention in this application) design input. Namely, it sets on the front face (1st refraction front face which is a body side front face) of the

lens of the above-mentioned conventional-type convex successive promotion. When setting DHn and surface refractive power of a lengthwise direction to DVn for the lateral surface refractive power [in / for DHf and the surface refractive power of a lengthwise direction / in lateral surface refractive power / DVf and the frequency measuring point N1 for Kon] in the frequency measuring point F1 for **, DHf+DHn<DVf+DVn and -- or it satisfies the relational expression used as DHn<DVn -- DVn-DVf>ADD/2 and -- It considers as the progressive refractive-power front face on which the relational expression used as DHn-DHf<ADD/2 is satisfied. As for the average surface refractive power of the whole convex, at this time, it is desirable to change into the convex configuration of the invention in this application without changing. For example, it is possible to maintain the gross mean value of the surface refractive power of a distance point and a reading point in every direction etc. However, a body side front face is a convex and it is desirable that it is within the limits which maintains the meniscus configuration whose eyeball side front face is concave.
[0050] ** -2 : add the deformation at the time of converting into the convex configuration of the invention in this application from the convex successive promotion side of a conventional type to the concave surface configuration designed by **-2 in concave surface configuration (invention in this application) design above-mentioned **-1. That is, only the same amount also as the rear-face (2nd refraction front face which is eyeball side front face) side of a lens applies the deformation of the front face (1st refraction front face which is a body side front face) of the lens added in the process of **-1. Please care about using it as the front face which satisfies not uniform deformation but the relational expression indicated to **-1 on the whole surface, although this deformation resembles the "bending" which bends the lens itself. In addition, although these rear-face amendments are the criteria of the invention in this application, it is desirable not to pass to primary approximation-amendment but to add rear-face amendment of **.
[0051] ** In order to realize in the situation that the wearing person wore actually the transparency design, the design corresponding to a listing rule, and the optical function that brought near among reading points and was imposed as rear-face amendment input accompanying a response design etc., it is desirable to add rear-face amendment further to the lens of the invention in this application obtained in **.
** -1 : the concave surface configuration (invention in this application) design transparency design for a transparency design is the design approach for obtaining an original optical function in the situation that the wearing person wore the lens actually, and it is the design approach of adding "an amendment operation" for removing or reducing generating of astigmatism and the change of frequency resulting from a look and a lens side mainly not intersecting perpendicularly.
[0052] Like the above-mentioned, a difference with the original optical-character ability which is the object is grasped by strict ray-tracing count according to the direction of a look, and, specifically, field amendment which negates the difference is carried out. By repeating this, a difference can be made to be able to minimum-ize and the optimal solution can be acquired. It is very difficult to compute directly the lens configuration which has target optical-character ability generally, and there are many things impossible as a matter of fact. This is because "the lens configuration which has the optical-character ability set as arbitration" does not necessarily exist really. However, it is comparatively easy this to ask reverse for "the optical-character ability of the lens configuration set as arbitration." Therefore, it is possible to carry out temporary count of the field of the first approximation by the approach of arbitration first, to tune said design parameter finely according to the assessment result of the optical-character ability of a lens configuration using the approximation side, to change a lens configuration serially, to repeat return, reevaluation, and readjustment to an assessment step, and to bring close to target optical-character ability. This technique is an example of the technique which is called "optimization" and known widely.
[0053] ** the concave surface configuration (invention in this application) design for the design corresponding to -2:listing rule -- the three-dimension-circumnutation of an eyeball in case we overlook a perimeter, although following the regulation called a "listing rule" is known When astigmatism frequency is in formula frequency, even if it sets the astigmatism shaft of a spectacle lens by "the

astigmatism shaft of the eyeball in front view", when a peripheral vision is carried out, both astigmatism shafts may not be in agreement. Thus, it can add to the curved surface of the front face of the side which has an astigmatism correction operation of the lens according "an amendment operation" for removing or reducing generating of astigmatism and the change of frequency resulting from the astigmatism shaft orientations of the lens and eye in a peripheral vision not being in agreement to this invention.
[0054] It is the same as that of the approach of "optimization" specifically used by **-1, and a difference with the original optical-character ability which is the object is grasped by strict ray-tracing count according to the direction of a look, and field amendment which negates the difference is carried out. By repeating this, a difference can be made to be able to minimum-ize and the optimal solution can be acquired.
[0055] ** -3 : by bringing near among reading points, although the concave surface configuration (invention in this application) design for a response design and this invention are field configurations called the double-sided aspheric surface, in acquiring the effectiveness of this invention, they do not necessarily need to process both sides for the first time after an award. For example, it is also useful to prepare beforehand the "semifinished product" of the body side front face which suits the object of this invention, to choose the "semifinished product" of the body side front face which suited the objects, such as formula frequency and above-mentioned custom-made (individual separate installation meter) one, out of them after the award, and to process and finish, after receiving only the order of an eyeball side front face in respect of cost and processing speed.
[0056] As an example of this approach, the body side front face is beforehand prepared as a "semifinished product" of bilateral symmetry in the convex configuration (invention in this application) design of above-mentioned **-1. the right and left which suited for the purpose of the eyeball side front face after individual humanity news, such as pupillary distance and the pair object distance of near viewing, was inputted -- **** can be performed among the reading points corresponding to individual humanity news by designing as an unsymmetrical curved surface.
[0057] Hereafter, the example of the double-sided aspheric surface successive promotion dioptric lens designed by the above-mentioned design approach is explained for a drawing, making it reference. Drawing which drawing 7 summarized the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding to examples 1, 4, 5, and 6 and each frequency in a table 1-1 and a table 1-2, and was shown, Drawing which drawing 8 summarized the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding to examples 2 and 7 and each frequency in a table 2-1 and a table 2-2, and was shown, Drawing which drawing 9 summarized the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding to an example 3 and its frequency in a table 3-1 and a table 3-2, and was shown, The graph 1-1 with which drawing 10 expresses surface refractive-power distribution of an example 1 and an example 2, 1-2, 2-1, drawing showing 2-2, The graph 3-1 with which drawing 11 expresses surface refractive-power distribution of an example 3, drawing showing 3-2, The graph 4-1 with which drawing 12 expresses surface refractive-power distribution of examples 4-6, 4-2, 5-1, 5-2, 6-1, drawing showing 6-2, The graph 7-1 with which drawing 13 expresses surface refractive-power distribution of an example 7, drawing showing 7-2, and drawing 14 are drawings showing the graph A-1 showing surface refractive-power distribution of the conventional technical examples A, B, and C, A-2, B-1, B-2, C-1, and C-2.
[0058] Drawing showing graph 1-3-Msv showing the result of having performed scale-factor distribution when drawing 15 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-Msh showing the result of having performed scale-factor distribution when drawing 16 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-Mpv showing the result of having performed scale-factor distribution when drawing 17 looks at the lens of an example 1 and three kinds of

conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-Mph showing the result of having performed scale-factor distribution when drawing 18 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-Mgammav showing the result of having performed scale-factor distribution when drawing 19 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-Mgammah showing the result of having performed scale-factor distribution when drawing 20 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 1-3-SMv showing the result of having performed scale-factor distribution when drawing 21 looks at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing 22 is drawing showing graph 1-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.

[0059] Drawing showing graph 2-3-Msv showing the result of having performed scale-factor distribution when drawing 23 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-Msh showing the result of having performed scale-factor distribution when drawing 24 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-Mpv showing the result of having performed scale-factor distribution when drawing 25 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-Mph showing the result of having performed scale-factor distribution when drawing 26 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-Mgammav showing the result of having performed scale-factor distribution when drawing 27 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-Mgammah showing the result of having performed scale-factor distribution when drawing 28 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 2-3-SMv showing the result of having performed scale-factor distribution when drawing 29 looks at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing 30 is drawing showing graph 2-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.

[0060] Drawing showing graph 3-3-Msv showing the result of having performed scale-factor distribution when drawing 31 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 3-3-Msh showing the result of having performed scale-factor distribution when drawing 32 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 3-3-Mpv showing the result of having performed scale-factor distribution when drawing 33 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and

having asked for strict scale-factor count, Drawing showing graph 3-3-Mph showing the result of having performed scale-factor distribution when drawing 34 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 3-3-Mgammav showing the result of having performed scale-factor distribution when drawing 35 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 3-3-Mgammah showing the result of having performed scale-factor distribution when drawing 36 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing showing graph 3-3-SMv showing the result of having performed scale-factor distribution when drawing 37 looks at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count, Drawing 38 is drawing showing graph 3-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.

[0061] (Example 1) The table 1-1 of drawing 7 is a chart about the surface refractive power of the example 1 by this invention. The frequency of this example 1 supports S0.00 Add3.00, and has written together three kinds of conventional technical examples of this frequency for the comparison. In addition, the conventional technical example B supports [the conventional technical example A / the conventional technical example C] the "concave surface progressive power lens" whose eyeball side front face is a progressive side at the "convex progressive power lens" whose body side front face is a progressive side at the "double-sided progressive power lens" both a body side front face and whose eyeball side front face are progressive sides, respectively. Moreover, the semantics of the item used with a table 1-1 is as follows.

DVf1: Surface refractive power DVn1 of the longitudinal direction in the frequency measuring point F1 for ** of the surface refractive-power DHf1:body side front face of the lengthwise direction in the frequency measuring point F1 for ** of a body side front face : Surface refractive-power DHnof lengthwise direction in number measuring point N1 of Kon supplies of body side front face 1: Surface refractive power DHf2 of the lengthwise direction in the frequency measuring point F2 for ** of the surface refractive-power DVf2:eyeball side front face of the longitudinal direction in the number measuring point N1 of the Kon supplies of a body side front face : Surface refractive-power DVnof longitudinal direction in frequency measuring point F2 for ** of eyeball side front face 2: Surface refractive power DHn2 of the lengthwise direction in the number measuring point N2 of the Kon supplies of an eyeball side front face: Surface refractive power of the longitudinal direction in the number measuring point N2 of the Kon supplies of an eyeball side front face [0062] The graph 1-1 of drawing 10 and 1-2 are the graphs showing the surface refractive-power distribution which met the main gaze line of an example 1, an axis of abscissa goes, right-hand side expresses the lens upper part, and, as for an axis of ordinate, left-hand side expresses surface refractive power for a lens lower part. Here, a graph 1-1 corresponds to a body side front face, and the graph 1-2 supports the eyeball side front face. Moreover, the graph of a continuous line expresses surface refractive-power distribution of the lengthwise direction which met the main gaze line, and the graph of a dotted line expresses surface refractive-power distribution of the longitudinal direction which met the main gaze line. In addition, these are the graphs explaining the fundamental difference in a field configuration, and, in aspheric-surface-izing for astigmatism clearance of a periphery, the astigmatism component addition for an astigmatism frequency response, etc., it has omitted.

[0063] Furthermore, as a graph showing the surface refractive-power distribution which met the main gaze line of three kinds of conventional technical examples of this frequency hung up over a table 1-1 for the comparison, to drawing 14 , it writes together that 2 is 2 and a graph B-1, and it is written together with a graph A-1 that 2 is a graph C-1. In addition, the semantics of the vocabulary in these graphs is as follows.

F1: The number measuring point of the Kon supplies of the frequency measuring-point N1:body side front face for ** of the frequency measuring point for ** of a body side front face, and an F2:eyeball side front face, the number measuring point valve flow coefficient 1 of the Kon supplies of an N2:eyeball side front face: The graph showing surface refractive-power distribution of the lengthwise direction which met the main gaze line of a body side front face (it expresses as a continuous line)
CH1: The graph showing surface refractive-power distribution of the longitudinal direction which met the main gaze line of a body side front face (it expresses as a dotted line)
valve flow coefficient2: The graph showing surface refractive-power distribution of the lengthwise direction which met the main gaze line of an eyeball side front face (it expresses as a continuous line)
CH2: The graph showing surface refractive-power distribution of the longitudinal direction which met the main gaze line of an eyeball side front face (it expresses as a dotted line)
[0064] Moreover, the surface refractive power in F1, N1, F2, and N2 of these graphs supports said table 1-1, and the semantics of vocabulary, such as DVf1 -DHn2, of it is also the same as that of the case of said table 1-1. In addition, the horizontal alternate long and short dash line which exists in the center of these graphs shows the average surface refractive power (gross mean value of the surface refractive power in every direction in F1 and N1) of a body side front face. Each average surface refractive power of the body side front face in the example 1 and three kinds of conventional technical examples by this invention was unified into 5.50diopter, and expected the fairness on a comparison.
[0065] Next, eight kinds of graphs which start in graph 1-3- shown in drawing 15 - drawing 22 are graphs showing the result of having performed the above-mentioned strict scale-factor count, and having searched for the scale-factor distribution when looking at the lens of the example 1 by this invention along with the main gaze line, an axis of abscissa goes, right-hand side expresses the lens upper part, and, as for an axis of ordinate, left-hand side expresses a scale factor for a lens lower part. The deep continuous line of drawing is an example 1, and, for the thin chain line, the conventional technical example A and the deep chain line are [the conventional technical example B and a thin continuous line] the conventional technical examples C. The same is said of this following kind of graph. In addition, in order to expect fairness, an axis of abscissa doubled the contraction scale of the scale factor of the axis of ordinate of each graph while it uses a cycloduction angle and could be made to perform the comparison for every direction of a look. the semantics of the sign attached after graph 1-3- shape factor of a Msv:lengthwise direction Msh: -- lateral shape factor Mpv: -- power factor of a lengthwise direction Mph: -- lateral power-factor Mgammav: -- prism factor of a lengthwise direction Mgammah: -- lateral prism factor SMv: -- it is the scale factor of a lengthwise direction, and the scale factor of a SMh:longitudinal direction, and the scale factor SMv of a lengthwise direction and the lateral scale factor SMh have a relation called SMv=MsvxMpvxMgammavSMh=MshxMphxMgammah like the above-mentioned.
[0066] In addition, each of examples 1 and said three kinds of conventional technical examples was made into a refractive index n= 1.699, t= 3.0mm of main thickness, and the specification that does not have prism focusing on [GC] geometry. About object power (inverse number of the pair object distance), it considered as object power Px=0.00 diopter (method of infinite distance) in F1 and F2, and object power Px=2.50 diopter (40cm) in N1 and N2, and the object power in other locations multiplied by it and gave 2.50diopter to the ratio of the addition refractive power which met the main gaze line. Moreover, it could be distance CR=13.0mm from the distance of L= 15.0mm from after [a lens] top-most vertices to cornea top-most vertices, and cornea top-most vertices to a cycloduction core. The cycloduction angle theta placed the cycloduction central point C on the normal passing through the geometrical core GC of a body side lens front face, made 0 times the angle of torsion when this normal and look are in agreement, and displayed the (+) lower part for the upper part by (-). considering as theta= +30.0 cycloduction angles over F1 and F2, and unifying into after an appropriate time at the cycloduction angle theta=-15.0 degree to N1 and N2 -- a progressive operation and distribution of surface refractive power -- a front flesh side -- even if it would be in which side, it considered so that the same conditions could compare.
[0067] About the example 1 by this invention, and three kinds of conventional technical examples

prepared for the comparison, the table 1-2 of drawing 7 is a chart of a strict scale-factor count result to the specific direction of a look, and supports graph 1-3-SMh (lateral comprehensive scale factor) of graph 1-3-SMv (comprehensive scale factor of a lengthwise direction) and drawing 22 of above-mentioned drawing 21 . Since a lengthwise direction differs in the value of a scale factor from a longitudinal direction like the above-mentioned explanation, both scale factors have been computed. Here, the semantics which the sign of a table 1-2 expresses is as follows.
SMvf : depth magnification SMvn on the look which passes through the point of measurement for ** : Depth magnification SMvfn on the look which passes through the point of measurement for Kon: Depth magnification difference (SMvn-SMvf)
SMhf : longitudinal direction scale factor SMhn on the look which passes through the point of measurement for ** : The longitudinal-direction scale factor SMhfn on the look which passes through the point of measurement for Kon: Longitudinal direction scale-factor difference (SMhn-SMhf)
[0068] Now, when SMvfn, SMhfn (SMvn-SMvf), i.e., the depth magnification difference, and the longitudinal direction scale-factor difference (SMhn-SMhf) of a table 1-2 are looked at, it turns out that 0.1380, 0.1015, and B are pressed [the conventional technical example A] down for 0.1360, 0.0988, and C to being 0.1342 and 0.0961 by the low scale-factor difference of 0.1342 and 0.0954 in the value of the example 1 by this invention. That is, since the scale-factor difference of the distance point and reading point of an example 1 by this invention has become less than the conventional technique 1 further, it turns out that it is further improved from the conventional technique 1 also about the distortion and the shake of an image. In addition, when calculating a scale factor, it is not taken at all into consideration about the difference in a lengthwise direction or a longitudinal direction by the patent specification corresponding to the above-mentioned conventional technique 1. However, scale-factor distribution of the image in a lengthwise direction and a longitudinal direction differs clearly so that it may understand, shortly after comparing 1-3-SMh (lateral comprehensive scale factor) of graph 1-3-SMv (comprehensive scale factor of a lengthwise direction) and graph drawing 22 of drawing 21 by the strict scale-factor count corresponding to the example 1 by this invention. Moreover, a remarkable thing can also mainly read this difference easily in a reading point and its lower part (on cycloduction angle - nearly 20 degrees or less).
[0069] Now, as it is in the formula of the above-mentioned scale factor, and scale-factor SMh=MshxMphxMgammah of the scale-factor SMv=MsvxMpvxMgammav longitudinal direction of a lengthwise direction Graph 1-3-SMv multiplies three elements and the value of graph 1-3-Msv, graph 1-3-Mpv, and graph 1-3-Mgammav, and is obtained. Similarly, graph 1-3-SMh multiplies three elements and the value of graph 1-3-Msh, graph 1-3-Mph, and graph 1-3-Mgammah, and is obtained. Although a clear difference will not be looked at by Msv and Msv which are a shape factor if the lengthwise direction and longitudinal direction of each element are compared here, at Mpv and Mph, a difference is seen more below than a reading point (on cycloduction angle - nearly 25 degrees or less). Moreover, at Mgammav and Mgammah, a remarkable difference is in a reading point and its lower part (on cycloduction angle - nearly 15 degrees or less). That is, the main cause of a difference of graph 1-3-SMv and graph 1-3-SMh is the difference between Mgammav and Mgammah, a secondary cause is the difference between Mpv and Mph, a clear difference is not looked at by Msv and Msh, but they understand that it is almost unrelated. That is, since that the difference in the scale factor of a lengthwise direction or a longitudinal direction is not looked at by the patent specification corresponding to the conventional technique 1 has disregarded the include angle of the pair object distance, a look, and a lens also about the power factors Mpv and Mph which are the secondary causes regardless of the prism factors Mgammav and Mgammah which are the main causes of a difference of a scale factor at all, a difference does not come out. Furthermore, as long as it sees by the contraction scale used in the example 1 of this invention also about the shape factors Msv and Msh made into the antecedent basis of an improvement in the conventional technique 1, the difference between each example is not looked at by the far and near scale-factor difference.
[0070] In addition, although [what "the scale-factor difference of a distance point and a reading point is reduced for" with the conventional technique 1] "The distortion and the shake of an image can be

lessened", I think that what "the scale-factor difference of a lengthwise direction and a longitudinal direction is reduced also for" further in this invention has the effectiveness "which can lessen the distortion and the shake of an image." That is, it is going to avoid that a square object looks flat or a round object is visible to an ellipse form. Probably, it will be more essential to catch about improvement in this visual sensation from what "a difference is reduced for", saying "A ratio is brought close to 1." I hear that the sensation which a square object appears [important one] flatly here, or is visible to an ellipse form is not "a far and near ratio" but an "aspect ratio", and there is. That is, the improvement effect "the distortion and the shake of an image can be lessened" is acquired by what [not only] "the scale-factor difference of a distance point and a reading point is reduced for" in this invention but the thing "the scale-factor difference of a lengthwise direction and a longitudinal direction is reduced, and a scale-factor ratio is brought close to 1" as a still more important improvement. In addition, these inclinations are mainly more remarkable than a reading point in a lower part (on cycloduction angle - nearly 25 degrees or less).

[0071] (Example 2) The table 2-1 of drawing 8 is a chart about the surface refractive power of the example 2 by this invention. The frequency of this example 2 supports S+6.00 Add3.00, and has written together three kinds of conventional technical examples of this frequency for the comparison. In addition, the conventional technical example B supports [the conventional technical example A / the conventional technical example C] the "concave surface progressive power lens" whose eyeball side front face is a progressive side at the "convex progressive power lens" whose body side front face is a progressive side at the "double-sided progressive power lens" both a body side front face and whose eyeball side front face are progressive sides, respectively. Moreover, the semantics of vocabulary, such as DVf1 -DHn2 used with a table 2-1, is the same as that of said table 1-1. 2 is a graph showing the surface refractive-power distribution which met the main gaze line of the example 2 according to this invention as a graph 2-1, an axis of abscissa goes, right-hand side expresses the lens upper part, and, as for an axis of ordinate, left-hand side expresses surface refractive power for a lens lower part. A graph 2-1 corresponds to a body side front face, and the graph 2-2 supports the eyeball side front face here. Moreover, the graph of a continuous line expresses surface refractive-power distribution of the lengthwise direction which met the main gaze line, and the graph of a dotted line expresses surface refractive-power distribution of the longitudinal direction which met the main gaze line. In addition, these are the graphs explaining the fundamental difference in a field configuration, and, in aspheric-surface-izing for astigmatism clearance of a periphery, the astigmatism component addition for an astigmatism frequency response, etc., it has omitted.

[0072] Furthermore, in the graph A-1 used in said example 1 as a graph showing the surface refractive-power distribution which met the main gaze line of three kinds of conventional technical examples of this frequency hung up over a table 2-1 for the comparison, 2 is used as 2 and a graph B-1, and 2 is again used as a graph C-1. Therefore, although the semantics of the vocabulary of these graphs is the same as said example 1, the surface refractive power in F1, N1, F2, and N2 shall all serve as a deep curve called 10.50diopter from the convenience which also makes the average surface refractive power of the body side front face which the horizontal alternate long and short dash line which shall be equivalent also to a table 2-1, and exists in the center shows correspond to a table 2-1.

[0073] Next, eight kinds of graphs which start in graph 2-3- shown in drawing 23 - drawing 31 are graphs showing the result of having performed the above-mentioned strict scale-factor count, and having searched for the scale-factor distribution when looking at the lens of the example 2 by this invention along with the main gaze line, and the semantics of the sign attached after the vocabulary or graph 2-3- etc. is the same as that of the case of said example 1. In addition, although [each of the refractive indexes or object power which were used in an example 2 and said three kinds of conventional technical examples, cycloduction angles, etc.] it is the same as that of the case of said example 1, since the frequency of an example 2 and three kinds of said conventional technical examples was S+6.00 Add3.00, the main thickness t was brought close to a product actual as 6.0mm.

[0074] About the example 2 by this invention, and three kinds of conventional technical examples prepared for the comparison, the table 2-2 of drawing 8 is a chart of a strict scale-factor count result to

the specific direction of a look, and supports the above-mentioned graph 2-3-SMv (comprehensive scale factor of a lengthwise direction), and graph 2-3-SMh (lateral comprehensive scale factor). Here, the semantics which the sign of a table 2-2 expresses is the same as the semantics of the above-mentioned table 1-2.
[0075] Now, when SMvfn, SMhfn (SMvn-SMvf), i.e., the depth magnification difference, and the longitudinal direction scale-factor difference (SMhn-SMhf) of a table 2-2 are looked at, it turns out that 0.2275, 0.1325, and B are pressed [the conventional technical example A] down for 0.2277, 0.1268, and C to being 0.2280 and 0.1210 by the low scale-factor difference of 0.2151 and 0.1199 in the value of the example 2 by this invention. That is, since the scale-factor difference of the distance point and reading point of an example 2 by this invention has become less than the conventional technique 1 further, it turns out that it is further improved from the conventional technique 1 also about the distortion and the shake of an image. In addition, like the above-mentioned example 1, scale-factor distribution of the image in a lengthwise direction and a longitudinal direction differs clearly so that it may understand, shortly after comparing graph 2-3-SMh (lateral comprehensive scale factor) with graph 2-3-SMv (comprehensive scale factor of a lengthwise direction) by the strict scale-factor count corresponding to the example 2 by this invention.
[0076] Moreover, a remarkable thing can also mainly read this difference in pars intermedia easily in a lower part (on cycloduction angle - nearly 10 degrees or less). It also sets in the example 2 as well as the above-mentioned example 1. Graph 2-3-SMv Now, three elements, The value of graph 2-3-Msv, graph 2-3-Mpv, and graph 2-3-Mgammav is multiplied, and it is obtained, and similarly, graph 2-3-SMh multiplies three elements and the value of graph 2-3-Msh, graph 2-3-Mph, and graph 2-3-Mgammah, and is obtained. Although a clear difference will not be looked at by Msv and Msv which are a shape factor if the lengthwise direction and longitudinal direction of each element are compared here, at Mpv and Mph, a difference is seen more below than a reading point (on cycloduction angle - nearly 20 degrees or less). Moreover, at Mgammav and Mgammah, a remarkable difference is in a lower part from pars intermedia (on cycloduction angle - nearly 10 degrees or less). Although a difference is seen here also above a distance point (it is nearly +20 degrees or more at a cycloduction angle), a distance point is quite the upper part (it is nearly +30 degrees or more at a cycloduction angle), and since operating frequency is also low, it can be disregarded that the difference by each example comes out.
[0077] That is, like the above-mentioned example 1, also in an example 2, the main cause of the difference of graph 2-3-SMv and drawing 30 of drawing 29 in graph 2-3-SMh is the difference between Mgammav and Mgammah, a secondary cause is the difference between Mpv and Mph, a clear difference is not looked at by Msv and Msh, but they understand that it is almost unrelated. Furthermore, as long as it sees by the contraction scale used in the example 2 of this invention also about the shape factors Msv and Msh made into the antecedent basis of an improvement in the conventional technique 1, the difference between each example is not looked at by the far and near scale-factor difference. In addition, also in the example 2, the improvement effect "the distortion and the shake of an image can be lessened" is acquired like the above-mentioned example 1 by what "the scale-factor difference of a lengthwise direction and a longitudinal direction is reduced, and a scale-factor ratio is brought close to 1 for" as a still more important improvement but what [not only] "the scale-factor difference of a distance point and a reading point is reduced for." In addition, these inclinations are mainly more remarkable than a reading point in a lower part (on cycloduction angle - nearly 25 degrees or less).
[0078] (Example 3) The table 3-1 of drawing 9 is a chart about the surface refractive power of the example 3 by this invention. The frequency of this example 3 supports S-6.00 Add3.00, and has written together three kinds of conventional technical examples of this frequency for the comparison. In addition, the conventional technical example B supports [the conventional technical example A / the conventional technical example C] the "concave surface progressive power lens" whose eyeball side front face is a progressive side at the "convex progressive power lens" whose body side front face is a progressive side at the "double-sided progressive power lens" both a body side front face and whose eyeball side front face are progressive sides, respectively. Moreover, the semantics of vocabulary, such as DVf1 -DHn2 used with a table 3-1, is the same as that of said table 1-1 and table 2-1.

[0079] 2 is a graph showing the surface refractive-power distribution which met the main gaze line of the example 3 according to this invention as the graph 3-1 of drawing 11 , an axis of abscissa goes, right-hand side expresses the lens upper part, and, as for an axis of ordinate, left-hand side expresses surface refractive power for a lens lower part. Here, a graph 3-1 corresponds to a body side front face, and the graph 3-2 supports the eyeball side front face. Moreover, the graph of a continuous line expresses surface refractive-power distribution of the lengthwise direction which met the main gaze line, and the graph of a dotted line expresses surface refractive-power distribution of the longitudinal direction which met the main gaze line. In addition, these are the graphs explaining the fundamental difference in a field configuration, and, in aspheric-surface-izing for astigmatism clearance of a periphery, the astigmatism component addition for an astigmatism frequency response, etc., it has omitted.
[0080] Furthermore, as a graph showing the surface refractive-power distribution which met the main gaze line of three kinds of conventional technical examples of this frequency hung up over the table 3-1 of drawing 9 for the comparison, in said graph A-1 used in an example 1 or 2, 2 is used as 2 and a graph B-1, and 2 is again used as a graph C-1. Therefore, although the semantics of the vocabulary of these graphs is the same as that of said example 1 or 2, the surface refractive power in F1, N1, F2, and N2 shall all serve as a shallow curve called 2.50diopter from the convenience which also makes the average surface refractive power of the body side front face which the horizontal alternate long and short dash line which shall be equivalent also to a table 3-1, and exists in the center shows correspond to a table 3-1.
[0081] Next, eight kinds of graphs which start in graph 3-3- shown in drawing 31 - drawing 38 are graphs showing the result of having performed the above-mentioned strict scale-factor count, and having searched for the scale-factor distribution when looking at the lens of the example 3 by this invention along with the main gaze line, and the semantics of the sign attached after the vocabulary or graph 3-3-etc. is the same as that of said example 1 or the case of 2. In addition, although [each of the refractive indexes or object power which were used in an example 3 and said three kinds of conventional technical examples, cycloduction angles, etc.] it is the same as that of said example 1 or the case of 2, since the frequency of an example 3 and three kinds of said conventional technical examples was S-6.00 Add3.00, the main thickness t was brought close to a product actual as 1.0mm.
[0082] About the example 3 by this invention, and three kinds of conventional technical examples prepared for the comparison, the table 3-2 of drawing 9 is a chart of a strict scale-factor count result to the specific direction of a look, and supports the above-mentioned graph 3-3-SMv (comprehensive scale factor of a lengthwise direction), and graph 3-3-SMh (lateral comprehensive scale factor). Here, the semantics which the sign of a table 3-2 expresses is the same as the semantics of the above-mentioned table 1-2 or a table 2-2.
[0083] Now, when SMvfn, SMhfn (SMvn-SMvf), i.e., the depth magnification difference, and the longitudinal direction scale-factor difference (SMhn-SMhf) of a table 3-2 are looked at, it turns out that its longitudinal direction scale-factor difference is decreasing although the value of the example 2 by this invention is a value of 0.0512 and 0.0726 and, as for the depth magnification difference, 0.0475, 0.0774, and B of the conventional technical example A are increasing [0.0418, 0.0750 and C] to being 0.0363 and 0.0727. However, by comparing the depth magnification difference with an above-mentioned example 1 and an above-mentioned example 2, gaps are also low values, such as 1/3 thru/or 1/5, and if it takes into consideration that the longitudinal direction scale-factor difference is decreasing slightly, the scale-factor difference of the distance point and reading point of an example 3 by this invention can be said to be practically equal compared with the conventional technique 1. However, if graph 3-3-SMv (comprehensive scale factor of a lengthwise direction) by the strict scale-factor count corresponding to the example 3 by this invention and graph 3-3-SMh (lateral comprehensive scale factor) are observed Compared with the conventional example, especially the example 3 by this invention has "few inclinations for the scale factor of a lengthwise direction to become smaller than 1" in a lower part (on cycloduction angle - nearly 20 degrees or less), its the "scale-factor difference in every direction" has become less than the reading point most as a result, and the distortion and the shake

of an image are improved rather than the conventional example.
[0084] In addition, in graph 3-3-SMv (comprehensive scale factor of a lengthwise direction) of drawing 37 , although it is the upper part (it is nearly +10 degrees or more at a cycloduction angle) of pars intermedia to a lower part (on cycloduction angle - nearly 10 degrees or less), and a distance point, that a difference remarkable in scale-factor distribution of the image in a lengthwise direction and a longitudinal direction comes out the difference by each example comes out -- a reading point -- a lower part (on cycloduction angle - nearly 20 degrees or less), and a distance point -- a little -- the upper part (it is nearly +25 degrees or more at a cycloduction angle) -- it is . the inside of this, and a distance point -- although it can ignore since operating frequency is also a little low about the upper part, from a reading point, it attaches caudad, and there is also much operating frequency and it cannot be disregarded. Consequently, compared with the conventional example, the "scale-factor difference in every direction" of the example [especially] 3 by this invention has become less [the scale factor of a lengthwise direction] than the reading point most most closely and its result in 1 in the lower part (on cycloduction angle - nearly 20 degrees or less), and the distortion and the shake of an image are improved rather than the conventional example. In addition, these inclinations are mainly more remarkable than a reading point in a lower part (on cycloduction angle - nearly 25 degrees or less). Moreover, about the shape factors Msv and Msh made into the antecedent basis of an improvement in the conventional technique 1, even if it sees like the example 1 and example 2 of this invention by the contraction scale used in the example 3, the difference between each example is not looked at by the far and near scale-factor difference.
[0085] (Examples 4-7) The combination of distribution of various surface refractive power is possible within limits indicated to the claim other than the above-mentioned examples 1-3 as an example of this invention. Here, examples 4-6 are shown as an example 1 and an application of this frequency, and an example 7 is shown as an example 2 and an application of this frequency. the chart and graph of the surface refractive power of these examples, and the strict scale-factor count result of the specific direction of a look -- the table 1-1 of drawing 7 , a table 1-2 and the graph 4-1 of drawing 12 - drawing 14 , and graph 4-2 or -- A graph 7-1 and graph 7-2 It is shown.
[0086] (Modification) In this invention, as an individual factor of the glasses wearing person whom it had not only the usual formula value but that a lens manufacturer grasps until now further For example, distance from cornea top-most vertices to lens back top-most vertices, distance from a cycloduction core to lens back top-most vertices, The difference of extent of the aniseikonia of a left right eye, and the height of a left right eye, the pair object distance of near viewing with the highest frequency, It is also possible by including in a lens design by making the arris location to the anteversion angle (the vertical direction) and gate angle (longitudinal direction) of a frame, and the direction of KOBA thickness of a lens etc. into input to meet the custom-made (individual separate installation meter) demand. Moreover, although this invention is a field configuration called the double-sided aspheric surface, in acquiring the effectiveness of this invention, it is not necessary to necessarily process both sides for the first time after an award. For example, it is also useful to prepare beforehand the "semifinished product" of the body side front face which suits the object of this invention, to choose the "semifinished product" of the body side front face which suited the objects, such as formula frequency and above-mentioned custom-made (individual separate installation meter) one, out of them after the award, and to process and finish, after receiving only the order of an eyeball side front face in respect of cost and processing speed.
[0087] As an example of this approach, it is possible to prepare beforehand the "semifinished product" of the body side front face of bilateral symmetry. and the right and left which corresponded to individual humanity news, such as pupillary distance and the pair object distance of near viewing, and suited for the purpose of the eyeball side front face about bringing near among the reading points corresponding to a convergence operation of the eye in near viewing -- it is possible to incorporate by considering as an unsymmetrical curved surface. of course -- although acquisition and the definite means of information -- such individual humanity news considers as not only location survey but presumption or an average and standard value -- can consider various cases -- those means -- this invention is not limited by how Moreover, in case optical count for including not only the usual formula value but the above-mentioned

individual factor in a lens design is performed, on the curved surface of both a body side front face, an eyeball side front face or a body side front face, and an eyeball side front face, it is also possible to add "an amendment operation" for removing or reducing generating of astigmatism and the change of frequency resulting from a look and a lens side mainly not intersecting perpendicularly.

[0088] Furthermore, when astigmatism frequency is in formula frequency, even if it sets the astigmatism shaft of a spectacle lens by "the astigmatism shaft of the eyeball in front view", when a peripheral vision is carried out, both astigmatism shafts may not be in agreement, although it is known that the three-dimension-circumnutation of an eyeball in case we generally overlook a perimeter is following the regulation called a "listing rule." Thus, it is also possible to add to the curved surface of the front face of the side which has an astigmatism correction operation of the lens according "an amendment operation" for removing or reducing generating of astigmatism and the change of frequency resulting from the astigmatism shaft orientations of the lens and eye in a peripheral vision not being in agreement to this invention.

[0089] As a definition of "the predetermined subscription frequency" in this invention, in addition, like drawing 6 Besides at the time of considering as the refractive-power difference which applied opening of a lens meter to the frequency measuring point F1 for ** of a body side front face, and the number measuring point N1 of the Kon supplies, and measured it The refractive power which applied opening of a lens meter to the frequency measuring point F2 for ** of an eyeball side front face, and measured it further when it considered as the refractive-power difference which applied opening of a lens meter to the frequency measuring point F2 for ** of an eyeball side front face, and the number measuring point N2 of the Kon supplies, and measured it, When it considers as a difference with the refractive power which was made to rotate a cycloduction center position as a core, and was measured by N3 towards the number measuring point N2 of the Kon supplies, it is also possible to adopt the definition [which] of these only using a horizontal refractive-power component especially as each refractive power.

[0090]

[Effect of the Invention] As explained in full detail above, according to this invention, in consideration of the effect by "the include angle of a look and a lens side", and the "pair object distance", by having computed the scale factor of an image correctly Good eyesight amendment of as opposed to [reduce the scale-factor difference of the image in a distance point and a reading point, and] a formula value, A wide range effective visual field with little distortion at the time of wearing can be given. It makes it possible to process it as an unsymmetrical curved surface. furthermore, the right and left corresponding to a convergence operation of an eye [in / using "the semifinished product of bilateral symmetry" as a body side front face / only for an eyeball side front face / to after an award / near viewing] -- The double-sided aspheric surface mold progressive power lens which makes it possible to reduce floor to floor time and cost can be obtained.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention is a lens used as for example, a progressive power lens for presbyopias for glasses. The 1st refraction front face which is a body side front face, and the 2nd refraction front face which is an eyeball side front face are equipped with the progressive refractive-power operation by which division allocation is carried out. It is related with the double-sided aspheric surface mold progressive power lens which has the composition of doubling said the 1st front face and said 2nd front face, and giving the frequency for ** based on a formula value (Df), and subscription frequency (ADD).

[Translation done.]

PRIOR ART

[Description of the Prior Art] Though a progressive power lens is a spectacle lens for presbyopias, generally the appearance top is widely used from the reasons of the advantage which is not easily perceived as spectacles for the aged, the advantage which can carry out clear vision continuously [there is no break from a long distance to a short distance, and]. However, without making a borderline intervene into a limited lens area From the convenience which arranges two or more visual fields that the visual field for seeing a distant place and the method of Kon were called the visual field for seeing, and visual field for seeing those in-between distance further The thing which a fault peculiar to a progressive power lens is -- the size of each visual field not being necessarily enough and the field which impresses the distortion and the shake of an image mainly in the visual field of the side exist -- is also known widely.
[0003] Although proposals various for many years had been made in order to improve a fault peculiar to these progressive power lenses, the thing of combination which the field configuration of those conventional progressive power lenses allotted the "progressive side" to the body side front face, and allotted the "spherical surface" and a "astigmatism side" to the eyeball side front face was almost the case. Moreover, these are on an eyeball side front face to reverse.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] As explained in full detail above, according to this invention, in consideration of the effect by "the include angle of a look and a lens side", and the "pair object distance", by having computed the scale factor of an image correctly Good eyesight amendment of as opposed to [reduce the scale-factor difference of the image in a distance point and a reading point, and] a formula value, A wide range effective visual field with little distortion at the time of wearing can be given. It makes it possible to process it as an unsymmetrical curved surface. furthermore, the right and left corresponding to a convergence operation of an eye [in / using "the semifinished product of bilateral symmetry" as a body side front face / only for an eyeball side front face / to after an award / near viewing] -- The double-sided aspheric surface mold progressive power lens which makes it possible to reduce floor to floor time and cost can be obtained.

[Translation done.]

* NOTICES *

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The main objects of these advanced technology are making a part or all of required subscription frequency share with an eyeball side front face from a body side front face, tend to reduce the scale-factor difference of a distance point and a reading point, and tend to improve the distortion and the shake of an image by the scale-factor difference. However, about the antecedent basis from which those improvement effects are acquired, there are few clear publications and there is a partial publication in said patent international disclosure WO 97/No. 19383 official report (henceforth the conventional technique 1) etc. slightly. That is, the formula of the lens scale factor SM shown in the following (1) equation - (3) equations is indicated by the conventional technique 1, and it is adopted as it as a basic assessment parameter of a lens design.
[0008] That is, the conventional technique 1 has the following publications. "Generally the scale factor SM of a lens is expressed with the following formula.
SM=MpxMs -- (1)
Here, Mp is called a power factor and Ms is called a shape factor. When the base curve (refractive power) of the field by the side of n and the body of a lens is set [the distance from the top-most vertices (inside top-most vertices) of the field by the side of the eyeball of a lens to an eyeball / the refractive power (inside vertex diopter) of the distance L between the tops, and inside top-most vertices / the thickness of the core of Po and a lens] to Pb for the refractive index of t and a lens, it is expressed as follows.
Mp=1/(1-LxPo) -- (2)
Ms=1/(1-(txPb)/n) -- (3)
In addition, in a formula (2) and count of (3), distance L and thickness are used about a base curve Pb, and a meter (m) is used [the inside vertex diopter Po] for diopter (D) about t, respectively. "
[0009] And the difference of the scale factor of a distance point and a reading point is computed using the formula of these lens scale factors SM, and with the conventional technique 1, since there are few the scale-factor differences, it is supposed that the distortion and the shake of an image are improved.
[0010] According to research of an invention-in-this-application person, although fixed effectiveness was accepted in the above-mentioned conventional technique 1 as compared with the advanced technology, in order to perform the lens design of high performance more, it became clear that there was the need of examining the following points further.
a. So that clearly also from the publication "the distance L from the top-most vertices of the field by the side of the eyeball of a lens to an eyeball", and "thickness [of the core of a lens] t", properly speaking, the parameter which should be applied only [near the center of a lens] is contained in the basic assessment parameter used with the above-mentioned conventional technique 1. That is, in the example of the conventional technique 1, since the basic assessment parameter which should be applied only to the distance point near the center of a lens will be applied from the lens core also to the reading point located caudad greatly, the possibility of the error by it remains.
[0011] b. With the conventional technique 1, the scale factor SM of a lens is computed with five basic assessment parameters which applied the "refractive index n of a lens" other than the above. However, if

the lens to which frequency was attached actually is leaned forward and backward, it will be thought that the magnitude of an image is strongly influenced at "the include angle of a look and a lens side" so that it may understand immediately. Therefore, by calculation of the scale factor of a reading point greatly located caudad especially from a lens core, it is thought that this "include angle of a look and a lens side" cannot be disregarded. Therefore, it has the possibility of the error by what "the scale factor of a lens is computed for, without taking into consideration the include angle of a look and a lens side" for the lens design of the conventional technique 1.

[0012] c. Since there is no concept of a direction in the "scale factor" in the conventional technique 1 in addition to the publication of the application to an astigmatism lens, when [which occurs in the reading point located caudad greatly from a lens core, for example] "The scale factors of a lengthwise direction and a longitudinal direction differ" is said, the possibility of the error by this arises.

[0013] d. In order to perform scale-factor count to a reading point to accuracy, the distance to a target, i.e., the "pair object distance", must be added as a count factor, but since it is not taken into consideration about this "pair object distance" with the conventional technique 1, the possibility of the error by it cannot be denied, either.

e. In scale-factor count, since the effect by prism operation is not taken into consideration, there is possibility of the error by this. Thus, especially the conventional technique has the possibility which is not necessarily enough for accuracy from a view of computing a "scale factor" more.

[0014] by be make in order to solve this technical problem, and compute the scale factor of an image correctly in consideration of the effect by "the include angle of a look and a lens side", and the "pair object distance", this invention reduce the scale factor difference of the image in a distance point and a reading point, and set it as the offer - double-sided aspheric surface mold progressive power lens which give wide range effective visual field with little good eyesight amendment [to a formula value] and the distortion at time of wearing object.

[0015] furthermore, the right and left corresponding to a convergence operation of an eye [in / using "the semifinished product of bilateral symmetry" as a body side front face / only for an eyeball side front face / to after an award / near viewing] -- it aims at offering the double-sided aspheric surface mold progressive power lens which makes it possible to process it as an unsymmetrical curved surface, and makes it possible to reduce floor to floor time and cost.

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OPERATION

As a progressive power lens characterized by making "a progressive operation" add, there is Atoral Variplas put on the market from French country Essel Optical Co. (the present Essilor) in 1970.
[0004] Moreover, as advanced technology proposed in recent years, ****** of a publication etc. is for example, in the patent international disclosure WO 97/No. 19382 and WO 97/No. 19383 official report, and, generally it is called rear-face successive promotion (or concave surface successive promotion) to them. The main objects of the field configuration in the rear-face successive promotion proposed in recent years [this] are making a part or all of required subscription frequency share with an eyeball side front face from a body side front face, tend to reduce the scale-factor difference of the image of a distance point and a reading point, and tend to improve the distortion and the shake of an image.
[0005] A thing given in WO 97/No. 19382 official report among these advanced technology is making a body side front face into the spherical surface or the symmetry-of-revolution aspheric surface.

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MEANS

[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, the 1st means Are the double-sided aspheric surface mold progressive power lens which equipped the 1st refraction front face which is a body side front face, and the 2nd refraction front face which is an eyeball side front face with the progressive refractive-power operation by which division allocation is carried out, and it sets on said 1st refraction front face. Set surface refractive power of the longitudinal direction in the frequency measuring point F1 for **, and surface refractive power of a lengthwise direction to DHfDVf, and they are set on said 1st refraction front face, respectively. When setting surface refractive power of the longitudinal direction in the **** frequency measuring point N1, and surface refractive power of a lengthwise direction to DHnDVn, respectively, while satisfying the relational expression used as DHf+DHn<DVf+DVn and DHn<DVn The surface astigmatism component in F1 and N1 on said 1st front face of refraction on said 2nd refraction front face Phase murder, It is the double-sided aspheric surface mold progressive power lens characterized by doubling said the 1st and 2nd refraction front face, and giving the frequency for ** based on a formula value (Df), and subscription frequency (ADD). The 2nd means is a double-sided aspheric surface mold progressive power lens concerning the 1st means characterized by satisfying the relational expression used as DVn-DVf>ADD/2, and DHn-DHf<ADD/2. The 3rd means is bilateral symmetry bordering on the one meridian where said 1st refraction front face passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface progressive power lens concerning the 1st or 2nd means characterized by bringing near only a predetermined distance inside, making it into the nose side, and supporting the convergence operation of the eye in near viewing. The 4th means is the surface of revolution where said 1st refraction front face used as the bus-bar the one meridian which passes along said frequency measuring point F1 for **. Said 2nd refraction front face is bilateral symmetry bordering on the one meridian which passes along the frequency measuring point F2 for ** on this 2nd front face of refraction. And arrangement of the number measuring point N2 of the Kon supplies on this 2nd front face of refraction is a double-sided aspheric surface mold progressive power lens given in the 1st which only a predetermined distance is brought near inside, is made into the nose side, and is characterized by supporting the convergence operation of the eye in near viewing - the 3rd either. When considering as the configuration which doubles said the 1st and 2nd refraction front face, and gives the frequency for ** based on a formula value (Df), and subscription frequency (ADD), the 5th means it is the 1- characterized by reducing generating of astigmatism and the change of frequency resulting from the look and lens side in a wearing condition not intersecting perpendicularly -- it is a double-sided aspheric surface mold progressive power lens concerning one means of 4.
[0017] An above-mentioned means is thought out based on the following elucidation results. Hereafter, it explains, making a drawing reference. The explanatory view of various kinds of surface refractive power [in / in drawing 1 / each location on the front face of a spectacle lens], Drawing 2 The

explanatory view of the physical relationship of an eyeball, a look, and a lens, In drawing 31, drawing 32, and the drawing 33 list The explanatory view about the difference in the scale factor at the time of drawing 41, drawing 42, and drawing 43 being the explanatory views about the scale factor of M gamma of prism, and watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens, The front view which drawing 51 is the explanatory view of the optical layout of a progressive power lens, and looked at the progressive power lens from the body side front face, Drawing 52 is the explanatory view of the optical layout of a progressive power lens, and the side elevation showing the cross section of a lengthwise direction, the elevation which drawing 53 is the explanatory view of the optical layout of a progressive power lens, and expresses a lateral cross section, and drawing 6 are the explanatory views showing the difference in the definition of "subscription frequency." In addition, in these drawings, in Sign F, the frequency measuring point for ** and N show the frequency measuring point for Kon, and Q shows a prism frequency measuring point. Moreover, other signs described in drawing 1 etc. express the surface refractive power in N of the longitudinal direction cross-section curve which passes along surface refractive-power DHn:N in F of the longitudinal direction cross-section curve which passes along surface refractive-power DHf:F in N of the lengthwise direction cross-section curve which passes along surface refractive-power DVn:N in F of the lengthwise direction cross-section curve which passes along DVf:F. Furthermore, when the refraction front face of drawing is the 1st refraction front face which is a body side front face, a subscript 1 is given to all signs, and in being the 2nd refraction front face which is an eyeball side front face, it attaches and identifies a subscript 2 to all signs.

[0018] Moreover, as for N1 and N2, signs F1 and F2 show the number measuring point of the Kon supplies of a body side front face and an eyeball side front face to the frequency measuring point for ** of a body side front face and an eyeball side front face, and this appearance. Furthermore, the E's S centering on C reference [an eyeball and C considered as the winding central point of an eyeball and]-spherical surface, and Lf and Ln are looks which pass along the frequency measuring point for **, and the number measuring point of the Kon supplies, respectively. Moreover, M is a curve which the look when carrying out a binocular vision from the transverse-plane upper part to a lower part passes and which is called the main gaze line. And F1, N1, F2, N2, and N3 show the part to which opening of the lens meter which changes with definitions of "subscription frequency" is applied.

[0019] First, it asked for the formula of the scale factor corresponding to the reading point improved the thing which is the technical problem of (a) of the above-mentioned conventional technique, and "which you make a parameter correspond to a reading point", and "by taking object distance into consideration" as follows. [which are the technical problem of (d)] That is, when Mp is made into a power factor and Ms is made into a shape factor, the scale factor SM of an image is SM=MpxMs. -- (1')

It is come out and expressed. Object power (inverse number of the object distance expressed with m unit) to a target is set to Px here. Refractive power [in / for the distance from the field by the side of the eyeball in the reading point of a lens to an eyeball / L and a reading point] (inside vertex diopter in a reading point) Po, The following relation will be materialized if the base curve (refractive power) of the field by the side of a body [in / for the refractive index of t and a lens / in the thickness in the reading point of a lens / the reading point of n and a lens] is set to Pb.

Mp=(1-(L+t) Px)/(1-LxPo) -- (2')

Ms=1/(1-tx(Px+Pb)/n) -- (3')

[0020] In these formulas, if each parameter is made to correspond to a distance point and 0 corresponding to infinite distance is substituted to Px which is the power display of object distance, it is in agreement with the formula of the above-mentioned conventional technique 1. That is, it is thought that the formula used in the conventional technique 1 was a formula only for far viewing which is the object distance of infinite distance. Now, although (1') is the same as that of the formula of the above-mentioned conventional technique 1, since the object distance of near viewing is generally about 0.3m-0.4m, Px which is the inverse number serves as an about [-2.5--3.0] value here. Therefore, since the molecule of (2') increases, Mp increases, and in (3'), since a denominator increases, Ms decreases. That is, it turns out that the effect of the shape factor Ms in near viewing is fewer than count of the

conventional technique 1. For example, it turns out that it is set to Ms=1 when the base curve (refractive power) of the field by the side of Pb=-Px, i.e., the body of a lens, is the value which is +2.5 to about +3.0, and it becomes completely unrelated [the shape factor in near viewing] to the scale factor of an image.

[0021] Now, each parameter is made to correspond to a reading point as mentioned above, and although it was able to ask for the formula in consideration of "object distance" of a scale factor, in order to compute the scale factor in actual near viewing, it must take into consideration also about "the include angle of a look and a lens side" which is the technical problem of (b) of said conventional technique 1 further. I hear that there is directivity in "the include angle of a look and a lens side", and an important thing is in it here. That is, taking into consideration "the include angle of a look and a lens side" is exactly taking into consideration to coincidence the directivity of "the scale factor of an image" which is the technical problem of (c) of said conventional technique 1.

[0022] When the 1st formula of above-mentioned - (1') (3') is improved in this viewpoint, there is a base curve (refractive power) Pb of the field by the side of the body in the inside vertex diopter Po in a reading point and a reading point as a count factor which "the include angle of a look and a lens side" influences. Inside vertex diopter of the lengthwise direction in a reading point when the approximate expression of Martin which set the angle of a look [in / for the angle of the look in near viewing and the optical axis of a reading point field to make / alpha and near viewing] and the normal of the body side front face in a reading point to make to beta, and was known well here is used :P ov=Pox (1+Sin2alphax4/3)
Inside vertex diopter of the longitudinal direction in a reading point :P oh=Pox (1+Sin2alphax1/3)
Longitudinal-section refractive power of the body side front face in a reading point :P bv=Pbx (1+Sin2betax4/3)
Cross-section refractive power of the body side front face in a reading point :P bh=Pbx (1+Sin2betax1/3)
It becomes. Thus, unless angle alpha, beta and Po, and Pb are zero, refractive power, a power factor, a shape factor, etc. serve as a value which is in every direction and is different, consequently a difference produces them for the scale factor of a lengthwise direction and a longitudinal direction.

[0023] Now, although the approximate expression was used in order to explain briefly what here, "refractive power changes according to the direction of a look", it is desirable to calculate these values by strict ray-tracing count in an actual optical design. The optical path which met the look, using a Snell's law as a non-limiting example of these count approaches is calculated. By computing the distance from L, t, and a body side refracting interface to the object point, next using the 1st ground form in differential geometry, the 2nd ground form, the formula of Weingarten, etc. in accordance with this optical path The refractive power which took the effect of the refraction on the optical path in a body side refracting interface and an eyeball side refracting interface into consideration is calculable. These formulas and count approaches are well-known very for many years, for example, since it is indicated by well-known reference "differential geometry" (Asakura Publishing Co., Ltd. issue first edition 1949 written by Kentaro Yano) etc., explanation is omitted.

[0024] Now, the consideration about four count factors of L, Po, t, and Pb which are the technical problem of above-mentioned (a) - (d) is also made by performing ray-tracing count strict in this way, and, of course, the strict scale-factor count of the reading point greatly located caudad from a lens core is attained in all the directions of a look. Thus, the above-mentioned item, the inside vertex diopter of the lengthwise direction in a reading point :P Inside vertex diopter of the longitudinal direction in ov reading point :P Longitudinal-section refractive power of the body side front face in oh reading point :P Cross-section refractive power of the body side front face in bv reading point :P About bh, it asks [rather than] in a still higher precision using the approximate expression of Martin.

[0025] Thus, what should also be made to correspond to the difference in the direction of a look altogether will be easily understood also about scale-factor count of the above-mentioned image from what "refractive power changes according to the direction of a look." Here, Mp is made into a power factor, Ms is made into a shape factor, and if the subscript of h is attached and expressed [longitudinal

direction / v and] about a lengthwise direction, the formula of above-mentioned - (1') (3') will be rewritten as follows about the scale factor SM of an image.
SMv=MpvxMsv -- (1v')
SMh=MphxMsh -- (1h')
Mpv=(1-(L+t) Px)/(1-LxPov) -- (2v')
Mph=(1-(L+t) Px)/(1-LxPoh) -- (2h')
Msv=1/(1-tx(Px+Pbv)/n) -- (3v')
Msh=1/(1-tx(Px+Pbh)/n) -- (3h')
[0026] The technical problem from (a) of said conventional technique 1 to (d) was able to be coped with as mentioned above. "The effect by prism operation" which is the above-mentioned technical problem of (e) when computing the scale factor in actual near viewing at the end is described. Although refractive power like a lens does not exist in the prism itself, the scale factor of M gamma of prism changes with whenever [incident angle / of the beam of light to prism], or outgoing radiation include angles. Here, the angular magnification gamma in case the beam of light which carried out incidence into the medium of a refractive index n out of the vacuum is refracted on a medium front face is considered like the left of drawing 31 and drawing 41. Snell law well known when the incident angle at this time was set to i and angle of refraction was set to r It is n=Sin i/Sin r. Moreover, the angular magnification gamma by refraction is expressed with gamma=Cos i/Cos r. Since it is n>=1, generally it is i>=r. It becomes and is set to gamma<=1. It is the case of i=r=0, i.e., vertical incidence, that gamma becomes maximum 1 here. Moreover, angle of refraction r When set to n= 1-/Sin r, gamma is the theoretical minimum value. gamma= 0 It becomes. this time -- i=pi/2 it is -- r is equal to the critical angle of total reflection in case a beam of light comes out out of a medium.
[0027] On the other hand, angular-magnification gamma' in case a beam of light comes out from the medium of a refractive index n into a vacuum becomes completely contrary to the above like the right of drawing 31 and drawing 41. That is, about an incident angle in case it is refracted on a medium front face from the interior of a medium and a beam of light comes out into a vacuum, i' and when angle of refraction is made into r', it is Snell law. It becomes 1-/n=Sin i'/Sin r' and angular magnification is expressed with gamma'=Cos i'/Cos r'. Since it is n>=1, generally it becomes r'>=i', and it is gamma'>=1. It becomes. gamma' becomes the minimum value 1 here. It is the case of i'=r'=0, i.e., vertical incidence. Moreover, gamma' is theoretical maximum when incident angle i' turns into n= 1-/Sin i'. It becomes gamma'=infinity. At this time, it is r'=pi/2, and i' is equal to the critical angle of total reflection in case a beam of light comes out out of a medium.
[0028] Like drawing 33 and drawing 43, the case where the beam of light which carried out incidence to the body side front face of one spectacle lens passes through the interior of a lens, carries out outgoing radiation from an eyeball side front face, and reaches an eyeball is considered (suppose henceforth that the 1 [same] as the inside of a vacuum is resembled, and the refractive index of air is thought in simple for simplification of explanation.). If angle of refraction of i' and the beam of light which carried out outgoing radiation is made into r', the incident angle of the beam of light which set to i the incident angle of the beam of light which carried out incidence of the refractive index of a spectacle lens to n and a body side front face, set angle of refraction to r, and arrived at the eyeball side front face from the interior of a lens The angular magnification of M gamma which penetrated two front faces of a spectacle lens is expressed with the product of two kinds of above-mentioned angular magnification, and becomes Mgamma=gammaxgamma'=(Cos ixCos i')/(Cos rxCos r'). This is unrelated to the refractive power on the front face of a lens, and is known as a scale factor of prism.
[0029] Here, they are i=r' and r=i' like drawing 31 and drawing 41. Considering a case, it will be set to Mgamma=gammaxgamma'=1 and there will be no change in the scale factor of the image seen through prism. However, when a beam of light carries out incidence at right angles to the body side front face of a spectacle lens like drawing 32, it is set to Mgamma=gamma'=Cos i'/Cos r'>=1, and conversely, when a beam of light carries out perpendicular outgoing radiation from the eyeball side front face of a spectacle lens like drawing 42, it is set to Mgamma=gamma=Cos i/Cos r<=1.
[0030] Here, I hear that there is directivity in the scale factor of Mgamma of these prism, and an

important thing is in it. That is, although considering distribution of the prism in a progressive power lens it naturally changes with frequency or formula prism values, there is little prism in the far viewing generally near the center of a lens, and the prism of the lengthwise direction in the near viewing located under the lens is large. Therefore, the scale factor of M gamma of prism can be said for effect to be large especially to the lengthwise direction of near viewing.

[0031] Now, it is closer to the configuration of drawing 32 which is Mgamma>=1 than drawing 31 which is Mgamma=1, and the near viewing of the progressive power lens in which a reading point has forward refractive power as not only a progressive power lens but the spectacle lens is carrying out the meniscus configuration whose body side front face is generally a convex, and whose eyeball side front face is concave, and it is shown in drawing 33, when it takes into consideration that the look in near viewing is downward is Mgamma>1 at least. It can say. Similarly, it is closer to the configuration of drawing 42 which is Mgamma<=1 than drawing 41 which is Mgamma=1, and the near viewing of the progressive power lens in which a reading point has negative refractive power as shown in drawing 43 is Mgamma<1 at least. It can say. therefore -- the near viewing of a progressive power lens by which a reading point has forward refractive power -- Mgamma>1 it is -- the near viewing of a progressive power lens by which a reading point has negative refractive power -- Mgamma<1 It becomes.

[0032] Like the above-mentioned, to being grasped only as a product of a power factor Mp and a shape factor Ms, the scale factor SM of the lens in said conventional technique 1 tends to multiply the scale factor of M gamma of prism further, and tends to obtain the scale factor of a right lens by this invention.

[0033] The scale factor of M gamma by this prism will be called a "prism factor" from contrast with Mp or Ms, and if the subscript of h is attached and expressed [longitudinal direction / v and] about a lengthwise direction, the formula of the above-mentioned (1v') and (1h') will be rewritten as follows about the scale factor SM of an image.

SMv=MpvxMsvxMgammav -- (1v")

SMh=MphxMshxMgammah -- (1h")

In addition, these Mgammav and Mgammah can be calculated in the computation of the above-mentioned strict ray tracing. Thereby, the technical problem of the effect by the prism operation in scale-factor count of the above-mentioned glasses was solvable.

[0034] Now, in the usual convex progressive power lens, the surface refractive power of the "progressive side" of a body side front face serves as a distance point < reading point. On the other hand, at the progressive power lens of said conventional technique 1, it is going to improve the distortion and the shake of the image of a progressive power lens by changing the rate of a far and near shape factor, and decreasing the scale-factor difference of a far and near image by using surface refractive power of the "progressive side" of a body side front face as a distance point = reading point etc. However, although the advantage that the scale-factor difference of the far and near image about a longitudinal direction decreased by lessening the far and near surface refractive-power difference of the "progressive side" of a body side front face arose in the consideration in the invention in this application, it turned out about the lengthwise direction that there are some problems in lessening a surface refractive-power difference.

[0035] The 1st problem is the effect of the prism factor Mgammav of a lengthwise direction. the case where are Mgammav<1 when the prism factor Mgammav of a lengthwise direction has negative refractive power like the above-mentioned, and it has forward refractive power -- Mgammav>1 although it becomes, the inclination is strengthened by lessening the surface refractive-power difference of a lengthwise direction -- having -- the frequency of a reading point -- positive/negative -- also when it is any, it separates from Mgammav=1 which is the scale factor of the naked eye. However, there is such no effect in the lateral prism factor Mgammah, and it is still Mgammah=1. A difference in every direction arises from the result, especially a reading point for the scale factor of the image covered caudad, and if some which should be essentially visible to a square are in plus frequency and are in minus frequency longwise, un-arranging [of looking oblong] arises.

[0036] The 2nd problem is a problem which occurs only when especially the lengthwise direction of a reading point has forward refractive power. By lessening the surface refractive-power difference of a

lengthwise direction, un-arranging [that the include angle of the look and lens side in near viewing serves as slant further, the power factor Mpv of the above-mentioned lengthwise direction increases, the scale factor SMv of a lengthwise direction will increase and the scale-factor difference of a far and near image will increase on the contrary by acting on the increase and the duplex of the prism factor Mgammav of a lengthwise direction which were the 1st problem] produces it.
[0037] That is, although lessening the far and near surface refractive-power difference of the progressive side which is a body side front face had an advantage about the longitudinal direction, about the lengthwise direction, it became clear that it was deteriorated on the contrary. Therefore, in the convex progressive power lens of a conventional type, the progressive side which is a body side front face can be divided into a lengthwise direction and a longitudinal direction, and the above-mentioned problem can be avoided by lessening a far and near surface refractive-power difference only about a longitudinal direction.
[0038] As stated above, the biggest description of the invention in this application is to define the assignment ratio of the 2nd page of the optimal front flesh side to each direction, and constitute the double-sided aspheric surface mold progressive power lens of one sheet about the progressive operation of a progressive power lens, after dividing into the lengthwise direction and longitudinal direction of a lens. For example, as an extreme example, all progressive operations of a lengthwise direction are given on a body side front face, and it is also the criteria of the invention in this application to give all lateral progressive operations on an eyeball side front face. In this case, all, only on one side, since the 2nd page of the front flesh side of a lens does not function as a usual progressive side, it cannot specify the subscription frequency as a progressive side. namely, a front flesh side -- any field serves as a progressive power lens which is not a progressive side. On the other hand, a difference assigns the "value" of required subscription frequency to the 2nd page of a front flesh side for all of a certain thing at an assignment ratio, and the above-mentioned various advanced technology constitutes the synthetic field with an astigmatism side etc. if needed, after assuming the substantial progressive side which gives each subscription frequency. That is, the point that the invention in this application differs on the above-mentioned advanced technology and an above-mentioned decision target is to constitute the double-sided aspheric surface mold progressive power lens which used for both sides the aspheric surface with the progressive operation which changes with directions.
[0039]
[Embodiment of the Invention] Hereafter, the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation of the invention in this application is explained. In addition, the following explanation explains the design approach used in order to obtain the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation first, and, subsequently to the gestalt of operation, explains the double-sided aspheric surface successive promotion dioptric lens to apply.
[0040] (Procedure of a lens design) The outline procedure of the optical design approach of the double-sided aspheric surface successive promotion dioptric lens concerning the gestalt of operation is as follows.
** Below the rear-face amendment accompanying conversion in the convex configuration of the double-sided design ** invention in this application as a setting ** convex progressive power lens of input, a rear-face amendment ** transparency design, a design corresponding to a listing rule accompanying it, etc., decompose into a still finer step and explain each procedure in full detail.
[0041] ** The setting input of input is divided roughly into the two following kinds (it omits except an optical design).
** -1 : it is data of a proper at an item proper information lens item. The refractive index Ne of a material, minimum core thick CTmin, the minimum KOBA thickness ETmin, a progressive side design parameter, etc.
** -2 : the frequencies for wearing person proper ****** (several spherical degrees S, the astigmatism frequency C, the astigmatism shaft AX, the prism frequency P, prism the base direction PAX etc.), the subscription frequency ADD, frame configuration data (three-dimension configuration data are

desirable), frame wearing data (an anteversion angle, gate angle, etc.), the distance between top-most vertices, layout data (PD for **, CD for Kon, eye point location, etc.), other data about an eyeball, etc. In addition, it brings near in the progressive band length and subscription frequency measuring method which are specified by the wearing person, and a reading point, and progressive side design parameters, such as an amount, are classified into wearing person proper information.
[0042] ** Divide and design as a convex progressive power lens of a conventional type to the double-sided design beginning as a convex progressive power lens at a convex and a concave surface.
** -1 : in order to realize the subscription frequency ADD and progressive band length which were given as convex configuration (convex successive promotion side) design input, design the field configuration of convex successive promotion of a conventional type according to the progressive side design parameter which is input. In the design in this step, it is possible to use conventional various well-known techniques, and the engineering of the invention in this application does not need.
[0043] There is a method of setting up the "prime meridian" equivalent to the backbone at the time of considering as the example of this approach, for example, constituting a lens side first. As for this "prime meridian", finally, it is desirable to consider as the "main gaze line" which hits the intersection of a look when a glasses wearing person does a binocular vision from the transverse-plane upper part (distant place) to a lower part (method of Kon), and a lens side. however, the inside of the method field of Kon corresponding to a convergence operation of the eye in near viewing -- bringing near -- etc. -- it is not necessary to bring near correspondence among this "main gaze line", and to necessarily perform it by arrangement so that it may mention later Therefore, a "main gaze line" here passes through the center of a lens, and defines it as the one meridian (prime meridian) of the lengthwise direction which divides a lens side into right and left. Since there is a lens the 2nd page of a front flesh side, this "prime meridian" will exist two front flesh sides. When it looks at this "prime meridian" perpendicularly to a lens side, it is visible in the shape of a straight line, but when a lens side is a curved surface, generally it becomes a curve in three-dimension space.
[0044] Next, the suitable refractive-power distribution along this "prime meridian" is set up based on information, such as predetermined subscription frequency and the die length of a progressive band. Although this refractive-power distribution can also carry out a division setup at the 2nd page of a front flesh side in consideration of the effect of the thickness of a lens, the include angle of a look and a refracting interface, etc., since the field configuration of convex successive promotion of a conventional type is designed, by the design in this step, all progressive operations shall be shown in the 1st refraction front face which is a body side front face. therefore -- for example, -- if transparency refractive power acquired is set to D when surface refractive power of the front face (1st refraction front face which is a body side front face) of a lens is set to D1 and surface refractive power of the rear face (2nd refraction front face which is an eyeball side front face) of a lens is set to D2 -- general -- It can ask in approximation as D**D1-D2. However, a body side front face is a convex and, as for the combination of D1 and D2, it is desirable that it is the meniscus configuration whose eyeball side front face is concave. Here, please care about that D2 is a forward value. Usually, although the rear face of a lens is a concave surface and serves as a negative value as surface refractive power, on these specifications, it considers as a forward value for the simplification of explanation, and it subtracts from D1 and suppose transparency refractive power that D is computed.
[0045] Dn=(N-1)/R generally defined by the following formula about relational expression with the shape of this surface refractive power and surface type -- here -- Dn: They are the refractive index of the surface refractive power (unit: diopter) of the n-th page, and N:lens material, and R:radius of curvature (unit: m). Therefore, 1/R= Dn/(N-1) which transformed the above-mentioned relational expression is used for the approach of converting distribution of surface refractive power into distribution of curvature. It means that the geometry of a "prime meridian" is decided uniquely and the "prime meridian" equivalent to the backbone at the time of constituting a lens side was set up by having acquired distribution of curvature.
[0046] Next, "the horizontal cross-section curvilinear group" equivalent to the rib at the time of constituting a lens side is needed. Although there is no need that the include angle which these

"horizontal cross-section curvilinear groups" and "prime meridians" cross is not necessarily right-angled, in order to simplify explanation, each "horizontal cross-section curve" shall cross a right angle on a "prime meridian" here. Furthermore, "the lateral surface refractive power" of "the horizontal cross-section curvilinear group" in an intersection with a "prime meridian" does not necessarily need to be equal to "the surface refractive power of a lengthwise direction" along a "prime meridian", and actually, as a claim has a publication, the invention in this application is based on the difference in the surface refractive power about a lengthwise direction and a longitudinal direction. However, in the design in this step, since the field configuration of convex successive promotion of a conventional type is designed, let surface refractive power of a lengthwise direction and a longitudinal direction in these intersections be an equal.

[0047] Now, although all "horizontal cross-section curves" can also be made into the simple circular curve which has the surface refractive power in these intersections, application incorporating various conventional techniques is also possible. There is a technique of JP,49-3595,B as a conventional technical example about the surface refractive-power distribution in alignment with "a horizontal cross-section curve." It is characterized by to have the surface refractive-power distribution which increases applying this near the center of a lens and applying to the side one cross-section curve which sets up "the horizontal cross-section curve" of a circular configuration mostly, and is located more nearly up than it from a center, and for the cross-section curve located caudad to have the surface refractive-power distribution which is missing from the side and decreases from a center. Thus, a "prime meridian" and "the horizontal cross-section curvilinear group" innumerably located in a line on it will constitute a lens side like the backbone and a rib, and a refracting interface is decided.

[0048] ** -2 : in order to realize the frequency for ** given as concave surface configuration (spherical-surface or astigmatism side) design input, design a concave surface configuration. If astigmatism frequency is in the frequency for **, it will become an astigmatism side, and it will become the spherical surface if there is nothing. At this time, the tilt angle between fields of core thick CT and the convex suitable for frequency, and a concave surface is also designed to coincidence, and the configuration as a lens is decided. The design in this step can also use conventional various well-known techniques, and the engineering of the invention in this application does not need it.

[0049] ** Convert into the configuration as a lens of the invention in this application from the convex progressive power lens of a conventional type according to frequency for **, the subscription frequency ADD, etc. accompanying conversion in the convex configuration of the invention in this application, and it which were given as rear-face amendment input.

** -1 : convert into the convex configuration of the invention in this application from the convex successive promotion side of a conventional type according to frequency for **, the subscription frequency ADD, etc. which were given as convex configuration (invention in this application) design input. Namely, it sets on the front face (1st refraction front face which is a body side front face) of the lens of the above-mentioned conventional-type convex successive promotion. When setting DHn and surface refractive power of a lengthwise direction to DVn for the lateral surface refractive power [in / for DHf and the surface refractive power of a lengthwise direction / in lateral surface refractive power / DVf and the frequency measuring point N1 for Kon] in the frequency measuring point F1 for **, $DHf+DHn<DVf+DVn$ and -- or it satisfies the relational expression used as $DHn<DVn$ -- $DVn-DVf>ADD/2$ and -- It considers as the progressive refractive-power front face on which the relational expression used as $DHn-DHf<ADD/2$ is satisfied. As for the average surface refractive power of the whole convex, at this time, it is desirable to change into the convex configuration of the invention in this application without changing. For example, it is possible to maintain the gross mean value of the surface refractive power of a distance point and a reading point in every direction etc. However, a body side front face is a convex and it is desirable that it is within the limits which maintains the meniscus configuration whose eyeball side front face is concave.

[0050] ** -2 : add the deformation at the time of converting into the convex configuration of the invention in this application from the convex successive promotion side of a conventional type to the concave surface configuration designed by **-2 in concave surface configuration (invention in this

application) design above-mentioned **-1. That is, only the same amount also as the rear-face (2nd refraction front face which is eyeball side front face) side of a lens applies the deformation of the front face (1st refraction front face which is a body side front face) of the lens added in the process of **-1. Please care about using it as the front face which satisfies not uniform deformation but the relational expression indicated to **-1 on the whole surface, although this deformation resembles the "bending" which bends the lens itself. In addition, although these rear-face amendments are the criteria of the invention in this application, it is desirable not to pass to primary approximation-amendment but to add rear-face amendment of **.

[0051] ** In order to realize in the situation that the wearing person actually wore the transparency design, the design corresponding to a listing rule, and the optical function that brought near among reading points and was imposed as rear-face amendment input accompanying a correspondence design etc., it is desirable to add rear-face amendment further to the lens of the invention in this application obtained in **.

** -1 : in order to remove or reduce generating of astigmatism and change of frequency which the concave surface configuration (invention in this application) design transparency design for a transparency design is the design approach for obtaining an original optical function in the situation that the wearing person actually wore the lens, and originate in that a look and a lens side cannot mainly intersect perpendicularly

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[Translation done.]

OPERATION

As a progressive power lens characterized by making "a progressive operation" add, there is Atoral Variplas put on the market from French country Essel Optical Co. (the present Essilor) in 1970.
[0004] Moreover, ****** of a publication etc. is for example, in the patent international public presentation WO 97/No. 19382 and WO 97/No. 19383 official report as advanced technology proposed in recent years, and, generally it is called rear-face successive promotion (or concave surface successive promotion). The main purposes of the field configuration in the rear-face successive promotion proposed in recent years [this] are making a part or all of required subscription frequency share with an eyeball side front face from a body side front face, tend to reduce the scale-factor difference of the image of a distance point and a reading point, and tend to improve the distortion and the shake of an image.
[0005] A thing given in WO 97/No. 19382 official report among these advanced technology is making a body side front face into the spherical surface or the symmetry-of-revolution aspheric surface.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view of various kinds of surface refractive power in each location on the front face of a spectacle lens.
[Drawing 2] It is the explanatory view of the physical relationship of an eyeball, a look, and a lens.
[Drawing 31] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 32] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 33] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 41] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 42] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 43] It is an explanatory view about the scale factor of M gamma of prism, and is an explanatory view about the difference in the scale factor at the time of watching using the difference arising from a plus lens and a minus lens, or the reading point which is mainly the lower part of a lens.
[Drawing 51] It is the explanatory view of the optical layout of a progressive power lens, and is the front view which looked at the progressive power lens from the body side front face.
[Drawing 52] It is the explanatory view of the optical layout of a progressive power lens, and is a side elevation showing the cross section of a lengthwise direction.
[Drawing 53] It is the explanatory view of the optical layout of a progressive power lens, and is an elevation showing a lateral cross section.
[Drawing 6] It is the explanatory view showing the difference in the definition of "subscription frequency."
[Drawing 7] It is drawing having shown the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding to examples 1, 4, 5, and 6 and each frequency in Table 1-1 and 1-2 collectively.
[Drawing 8] It is drawing having shown the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding to examples 2 and 7 and each frequency in Table 2-1 and 2-2 collectively.
[Drawing 9] It is drawing having shown the "surface refractive power" and "the specific strict scale-factor count result of the direction of a look" of the conventional techniques A, B, and C corresponding

to an example 3 and its frequency in Table 3-1 and 3-2 collectively.
[Drawing 10] It is drawing showing the graph 1-1 showing surface refractive-power distribution of an example 1 and an example 2, 1-2, 2-1, and 2-2.
[Drawing 11] They are the graph 3-1 showing surface refractive-power distribution of an example 3, and drawing showing 3-2.
[Drawing 12] It is drawing showing the graph 4-1 showing surface refractive-power distribution of examples 4-6, 4-2, 5-1, 5-2, 6-1, and 6-2.
[Drawing 13] They are the graph 7-1 showing surface refractive-power distribution of an example 7, and drawing showing 7-2.
[Drawing 14] It is drawing showing the graph A-1 showing surface refractive-power distribution of the conventional technical examples A, B, and C, A-2, B-1, B-2, C-1, and C-2.
[Drawing 15] It is drawing showing graph 1-3-Msv showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 16] It is drawing showing graph 1-3-Msh showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 17] It is drawing showing graph 1-3-Mpv showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 18] It is drawing showing graph 1-3-Mph showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 19] It is drawing showing graph 1-3-Mgammav showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 20] It is drawing showing graph 1-3-Mgammah showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 21] It is drawing showing graph 1-3-SMv showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 22] It is drawing showing graph 1-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 1 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 23] It is drawing showing graph 2-3-Msv showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 24] It is drawing showing graph 2-3-Msh showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.

[Drawing 25] It is drawing showing graph 2-3-Mpv showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 26] It is drawing showing graph 2-3-Mph showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 27] It is drawing showing graph 2-3-Mgammav showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 28] It is drawing showing graph 2-3-Mgammah showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 29] It is drawing showing graph 2-3-SMv showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 30] It is drawing showing graph 2-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 2 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 31] It is drawing showing graph 3-3-Msv showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 32] It is drawing showing graph 3-3-Msh showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 33] It is drawing showing graph 3-3-Mpv showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 34] It is drawing showing graph 3-3-Mph showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 35] It is drawing showing graph 3-3-Mgammav showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 36] It is drawing showing graph 3-3-Mgammah showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.
[Drawing 37] It is drawing showing graph 3-3-SMv showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-

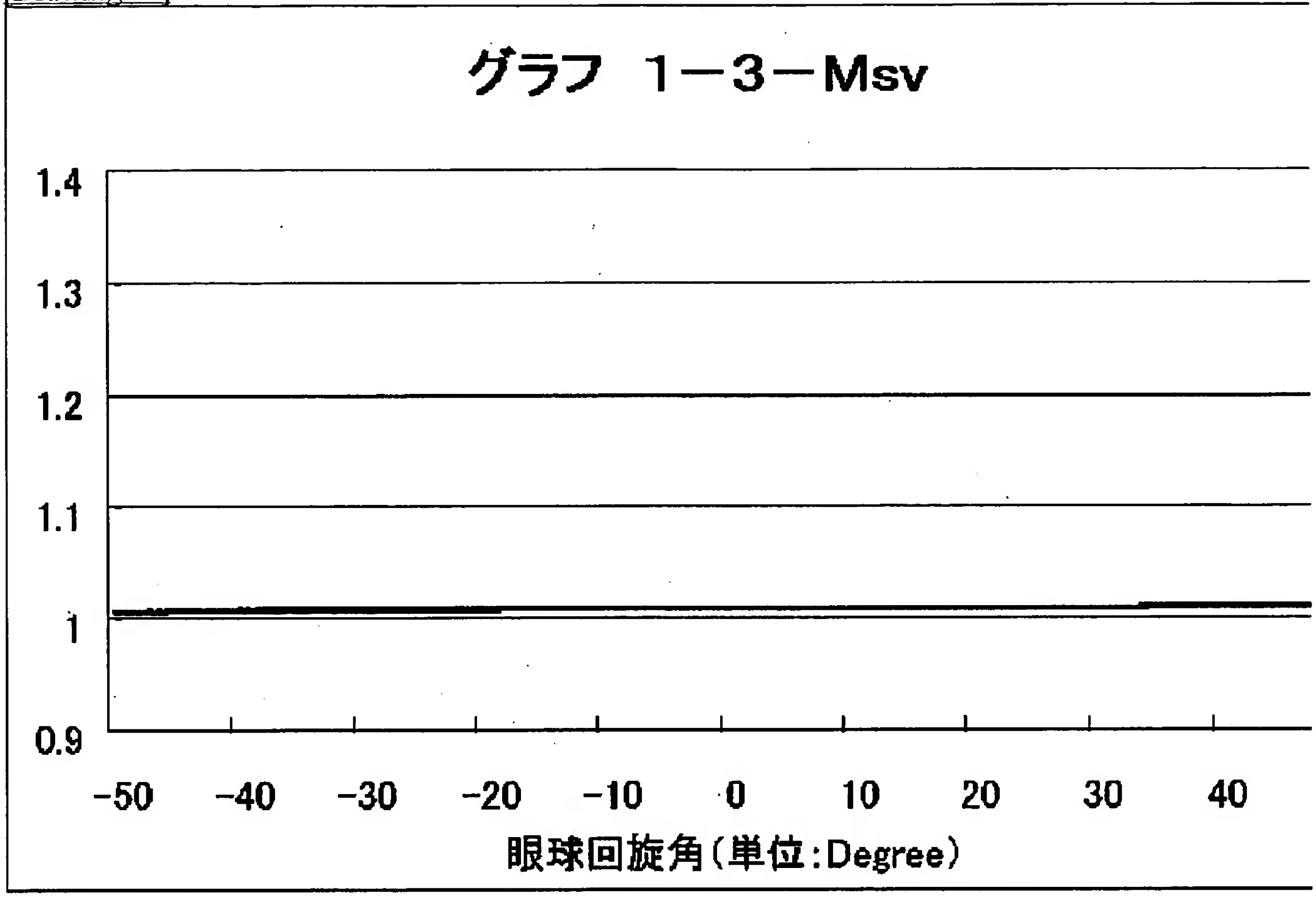
factor count.
[Drawing 38] It is drawing showing graph 3-3-SMh showing the result of having performed scale-factor distribution when looking at the lens of an example 3 and three kinds of conventional examples A, B, and C corresponding to the frequency along with the main gaze line, and having asked for strict scale-factor count.

[Translation done.]

WRITTEN AMENDMENT

-- [a procedure revision]
[Filing Date] July 1, Heisei 14 (2002. 7.1)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] 0073
[Method of Amendment] Modification
[Proposed Amendment]
[0073] Next, eight kinds of graphs which start in graph 2-3- shown in drawing 23 - drawing 30 are graphs showing the result of having performed the above-mentioned strict scale-factor count, and having searched for the scale-factor distribution when looking at the lens of the example 2 by this invention along with the main gaze line. The semantics of the sign attached after the vocabulary or graph 2-3- etc. is the same as that of the case of said example 1, except that the deep continuous line of drawing is an example 2. In addition, although [each of the refractive indexes or object power which were used in an example 2 and said three kinds of conventional technical examples, cycloduction angles, etc.] it is the same as that of the case of said example 1, since the frequency of an example 2 and three kinds of said conventional technical examples was S+6.00 Add3.00, the main thickness t was brought close to a product actual as 6.0mm.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0081
[Method of Amendment] Modification
[Proposed Amendment]
[0081] Next, eight kinds of graphs which start in graph 3-3- shown in drawing 31 - drawing 38 are graphs showing the result of having performed the above-mentioned strict scale-factor count, and having searched for the scale-factor distribution when looking at the lens of the example 3 by this invention along with the main gaze line. The semantics of the sign attached after the vocabulary or graph 3-3- etc. is the same as that of said example 1 or the case of 2, except that the deep continuous line of drawing is an example 3. In addition, although [each of the refractive indexes or object power which were used in an example 3 and said three kinds of conventional technical examples, cycloduction angles, etc.] it is the same as that of said example 1 or the case of 2, since the frequency of an example 3 and three kinds of said conventional technical examples was S-6.00Add3.00, the main thickness t was brought close to a product actual as 1.0mm.
[Procedure amendment 3]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 15
[Method of Amendment] Modification
[Proposed Amendment]

[Drawing 15]



[Procedure amendment 4]
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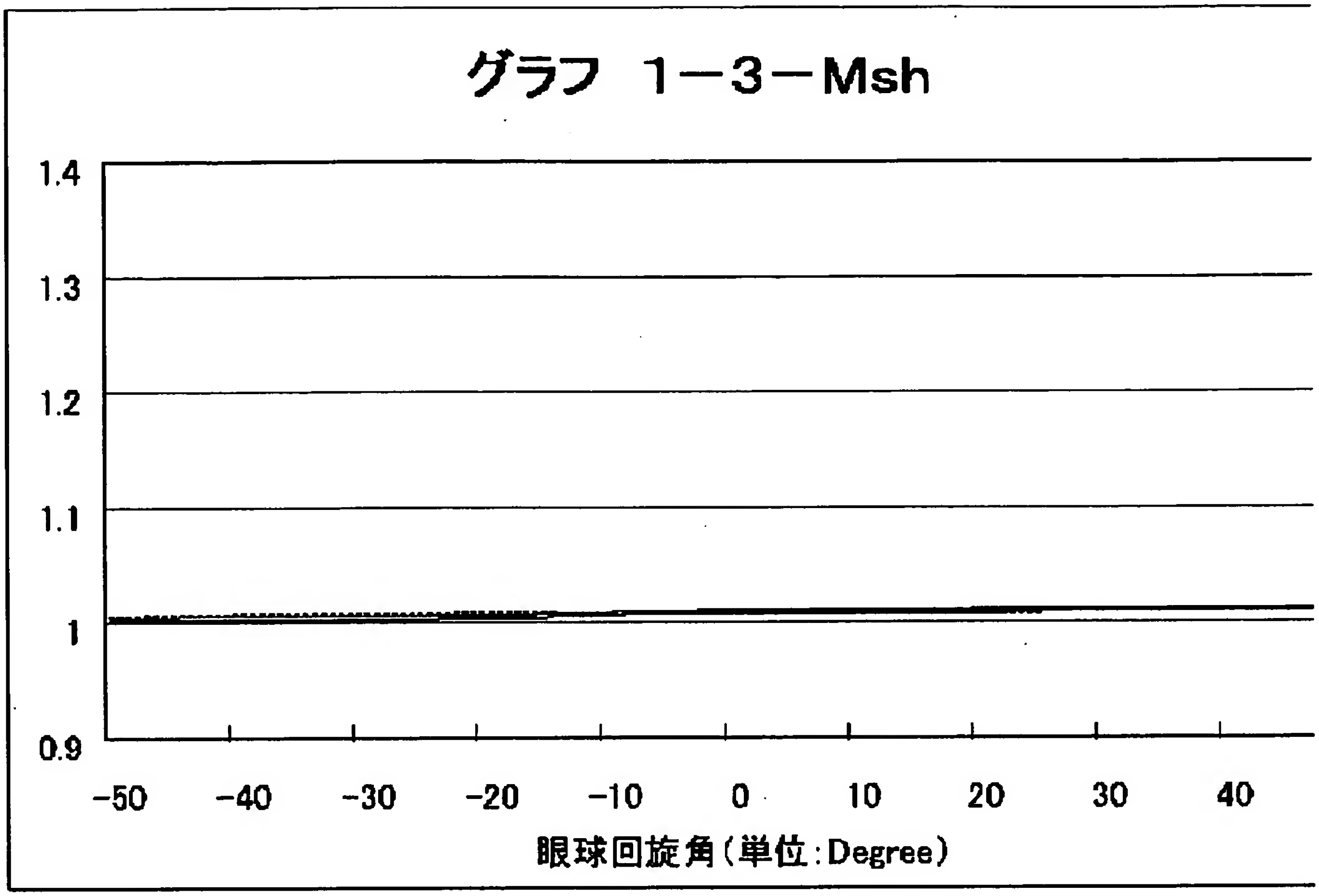
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 16]



[Procedure amendment 5]
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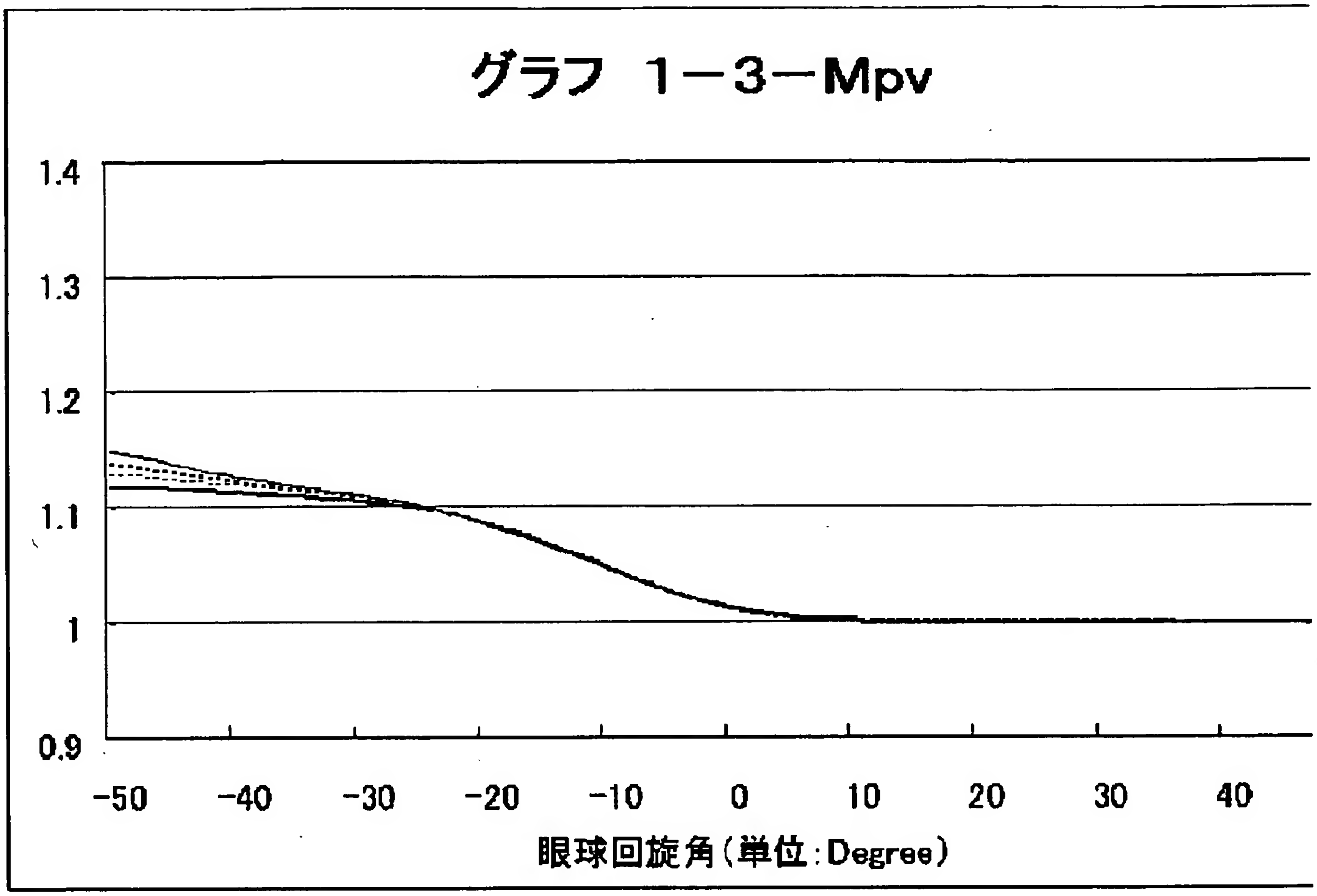
[Item(s) to be Amended] drawing 17
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 17]



[Procedure amendment 6]
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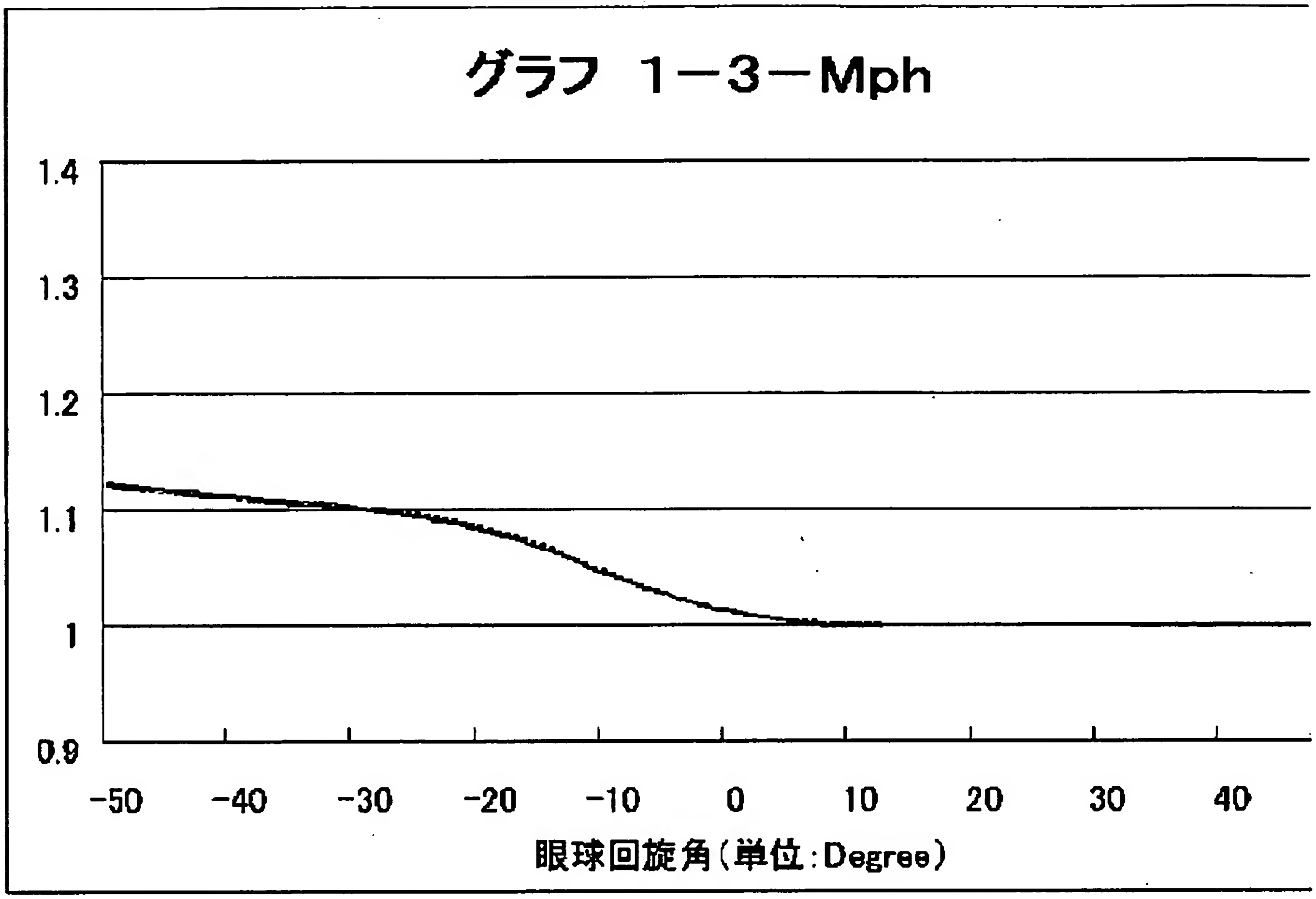
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 18]



[Procedure amendment 7]
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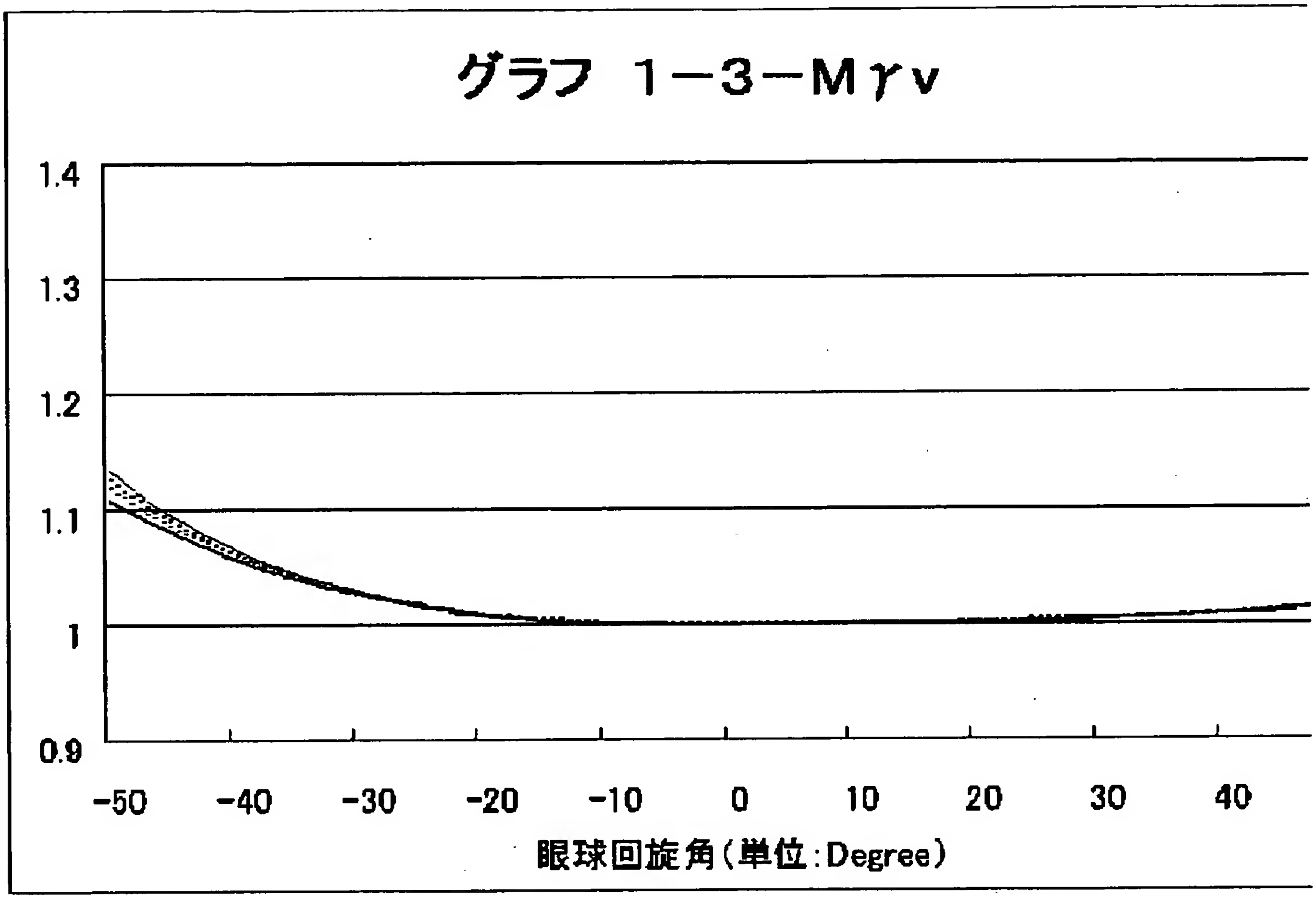
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 19]



[Procedure amendment 8]
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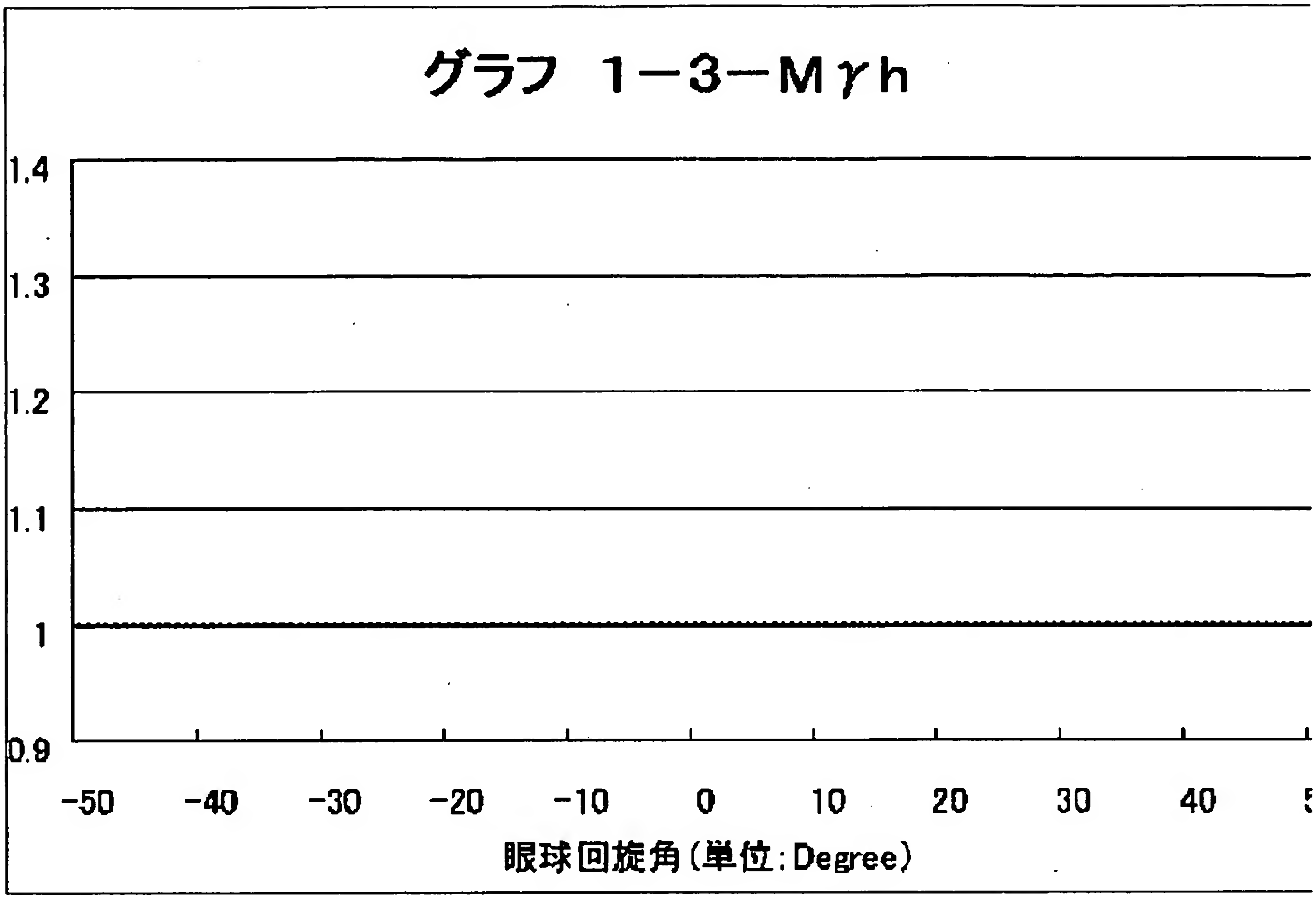
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 20]



[Procedure amendment 9]
[Document to be Amended] DRAWINGS
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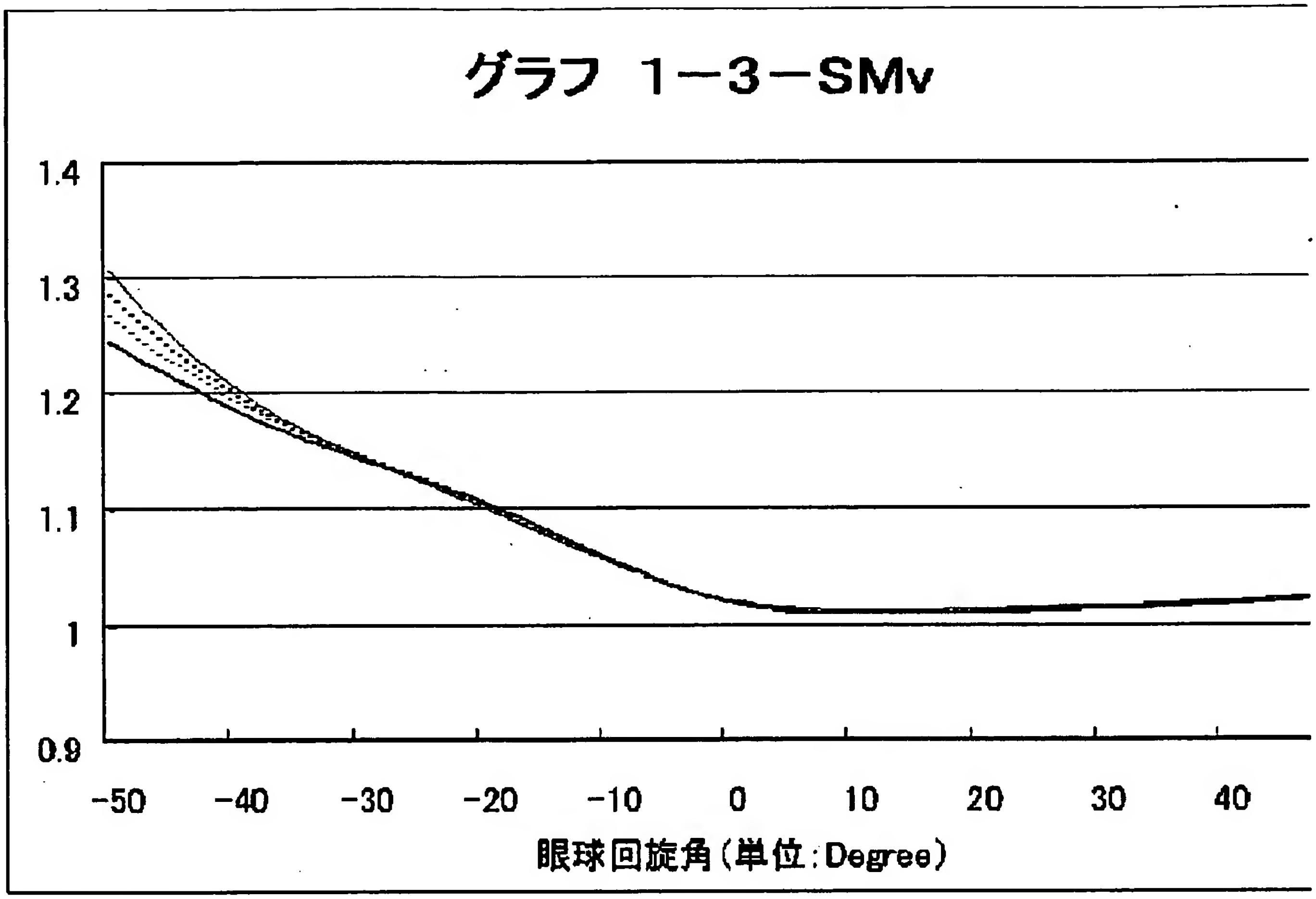
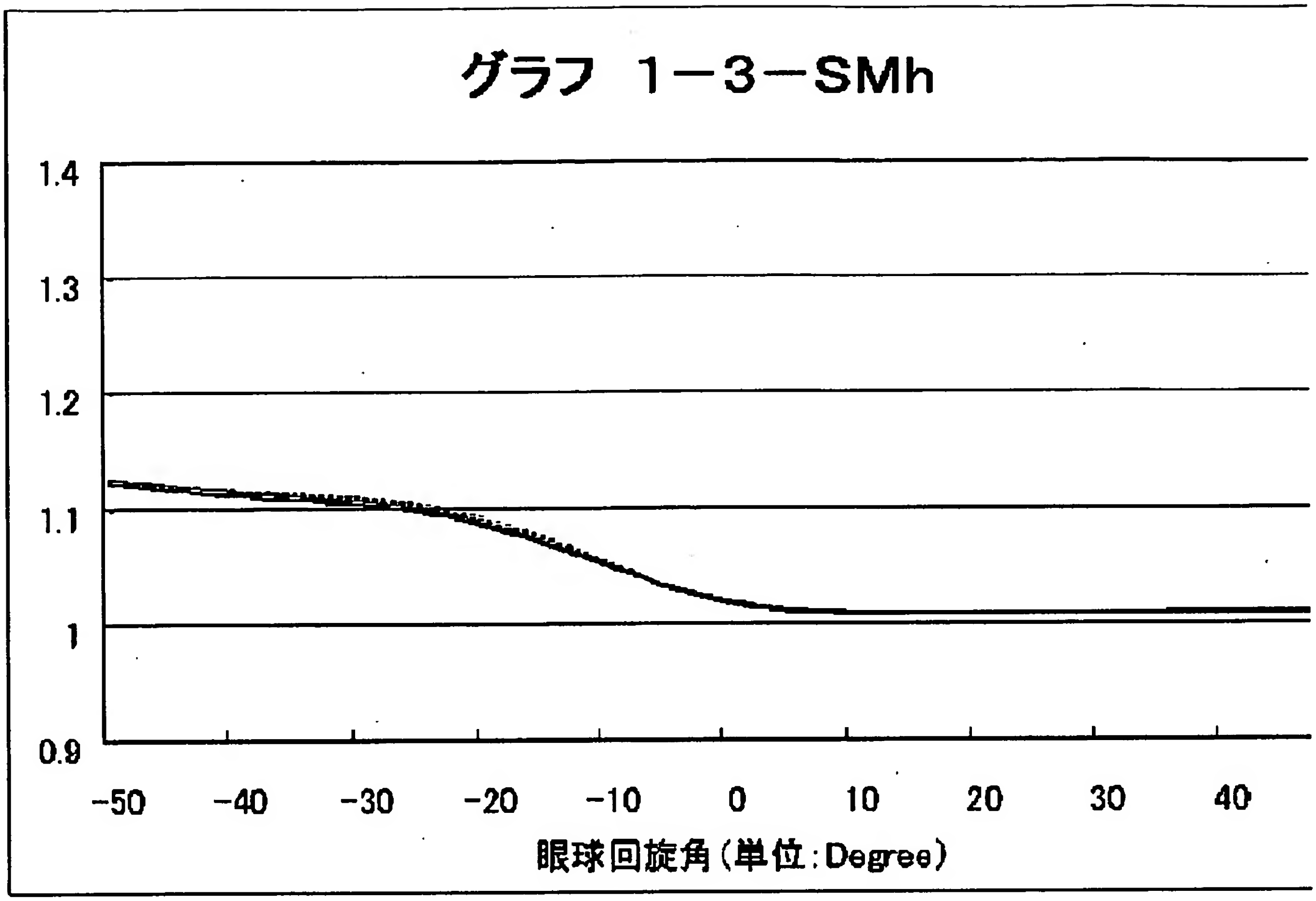
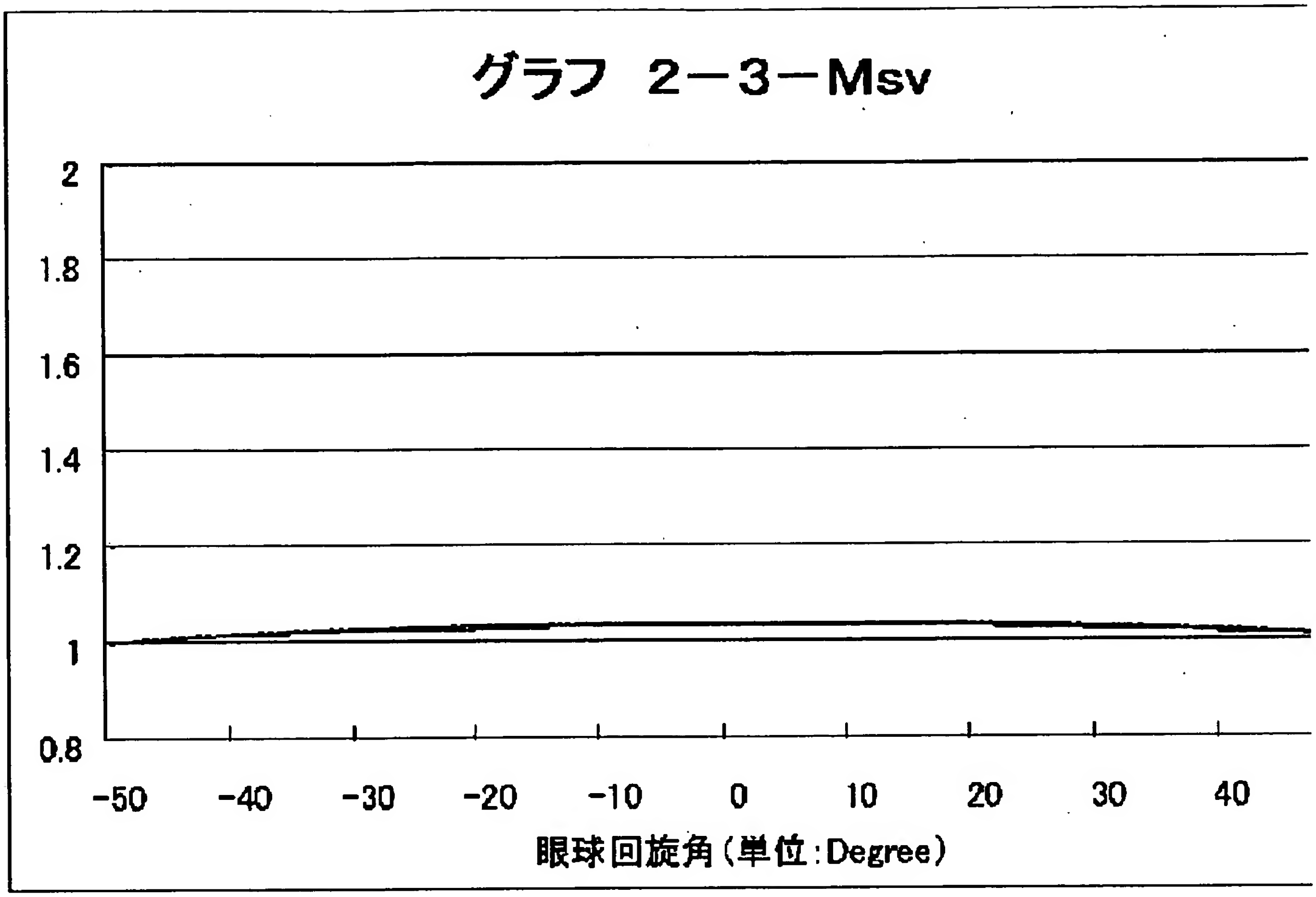
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 21]



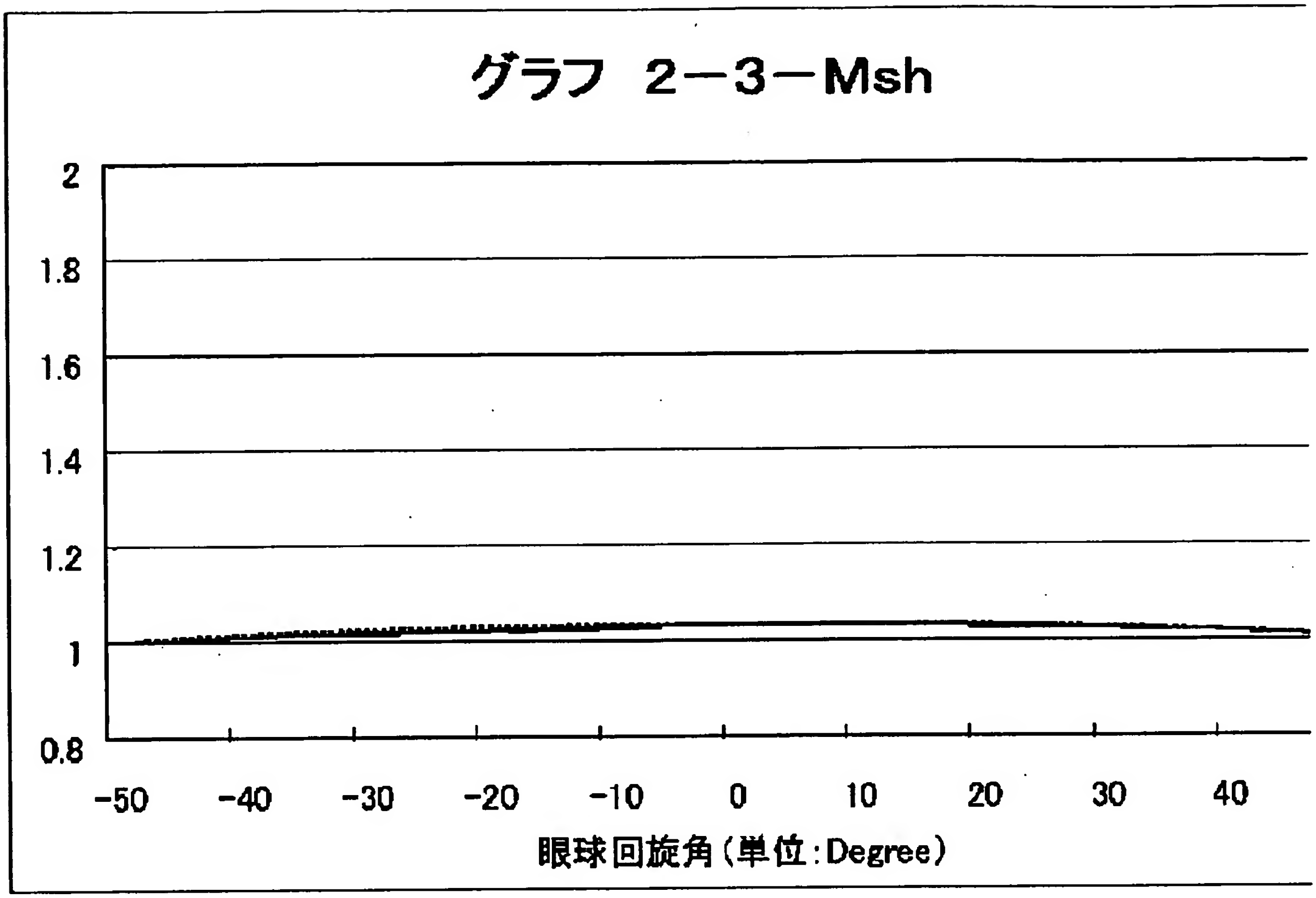
[Procedure amendment 10]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 22
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 22]



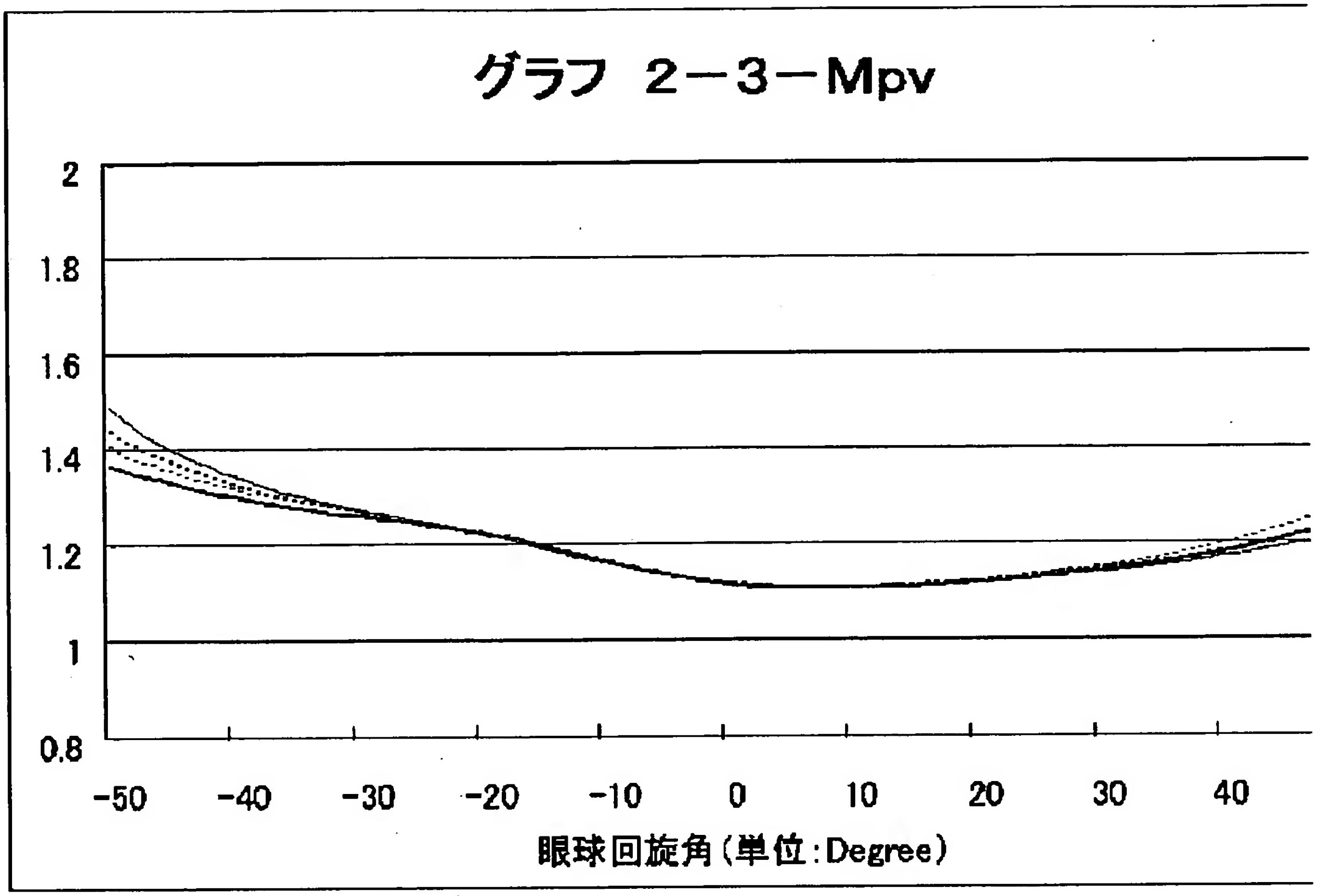
[Procedure amendment 11]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 23
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 23]



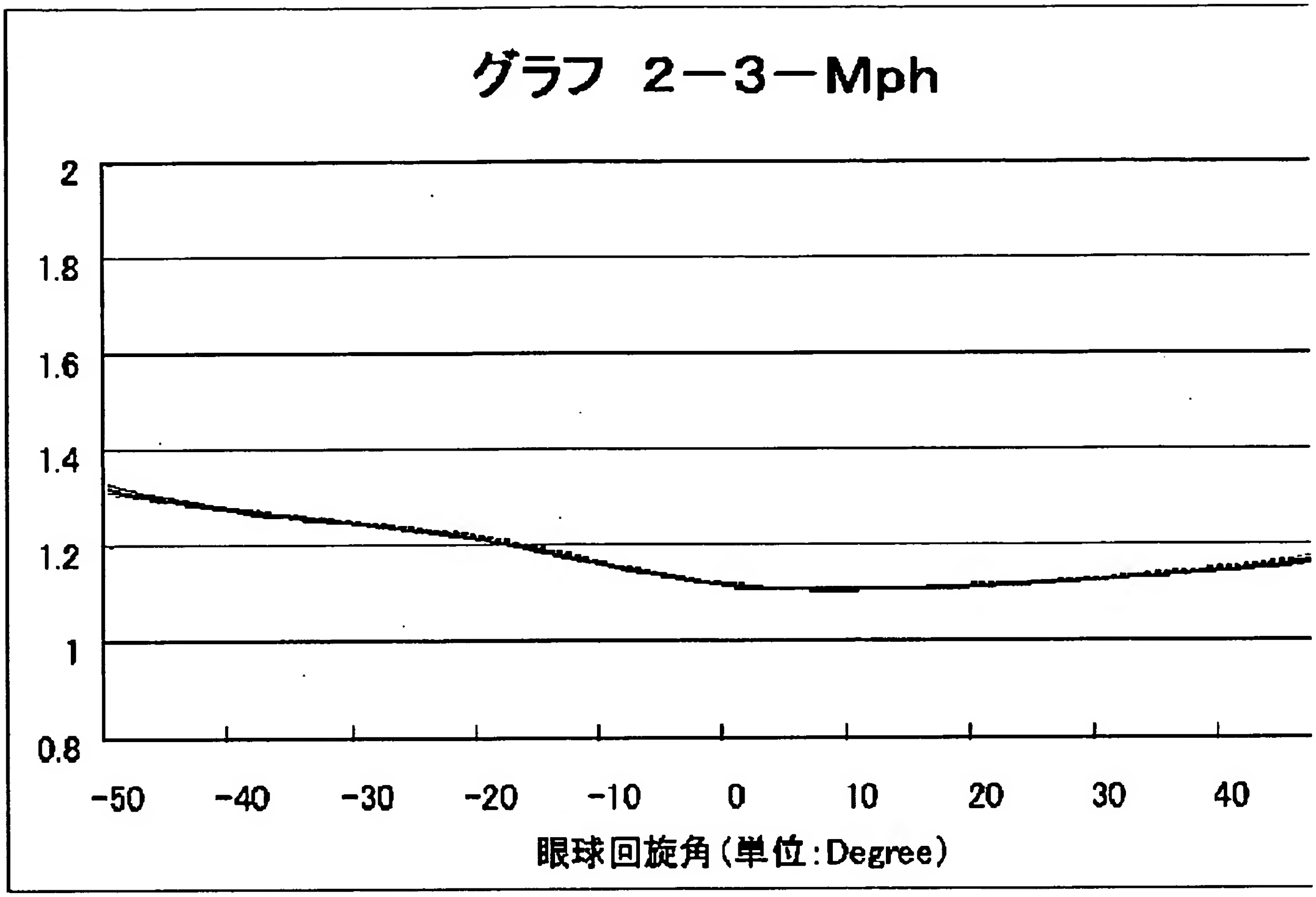
[Procedure amendment 12]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 24
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 24]



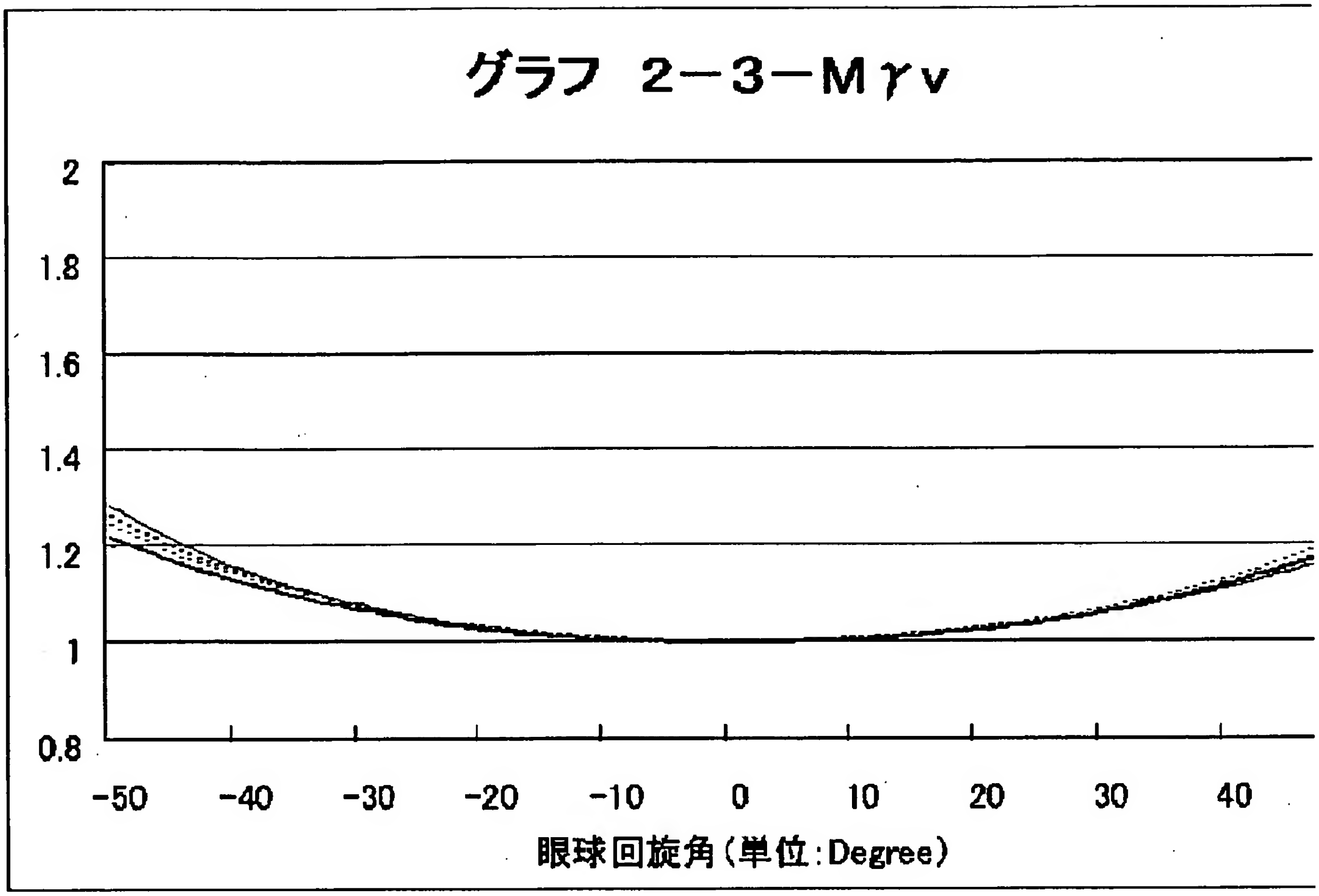
[Procedure amendment 13]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 25
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 25]



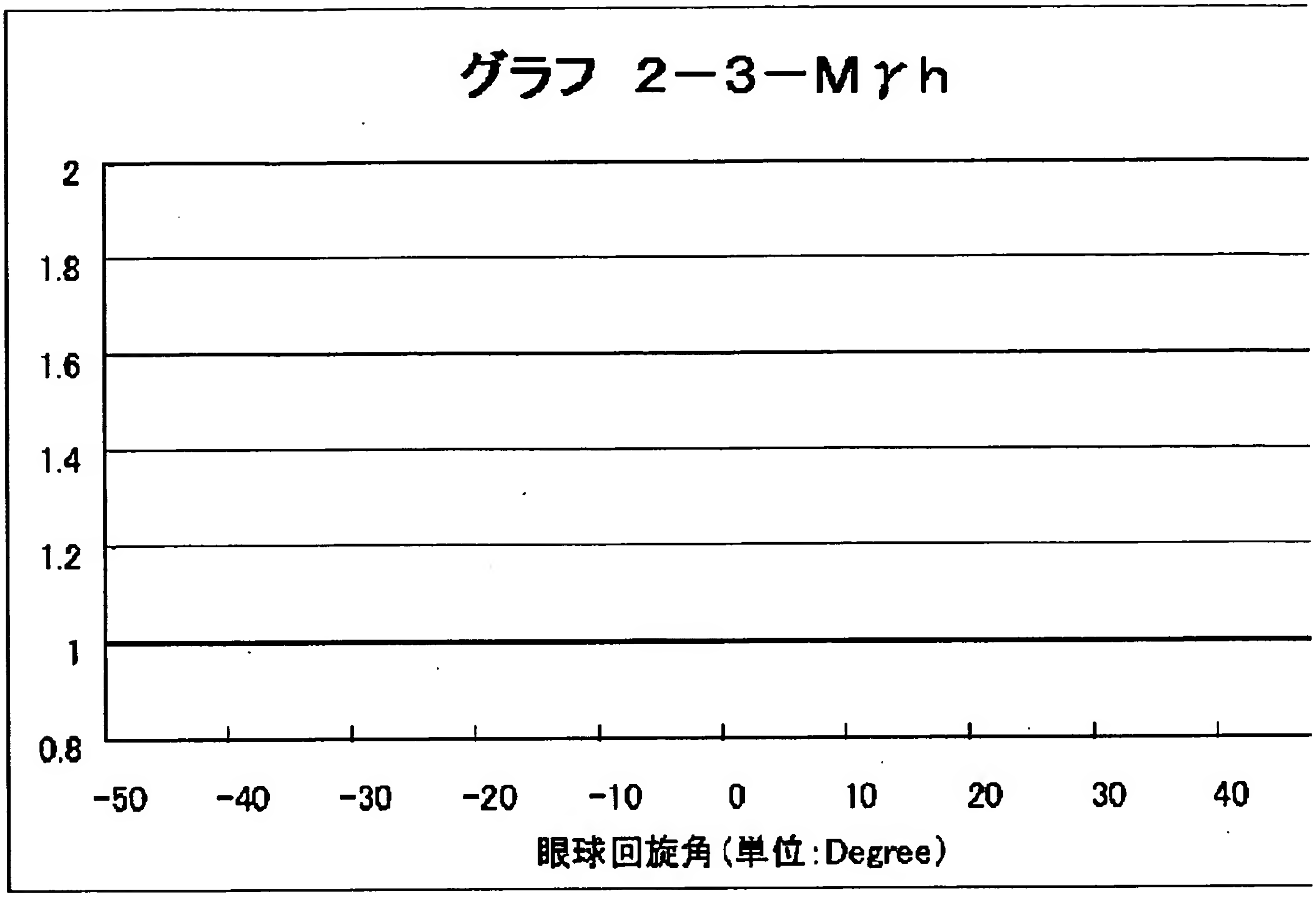
[Procedure amendment 14]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 26
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 26]



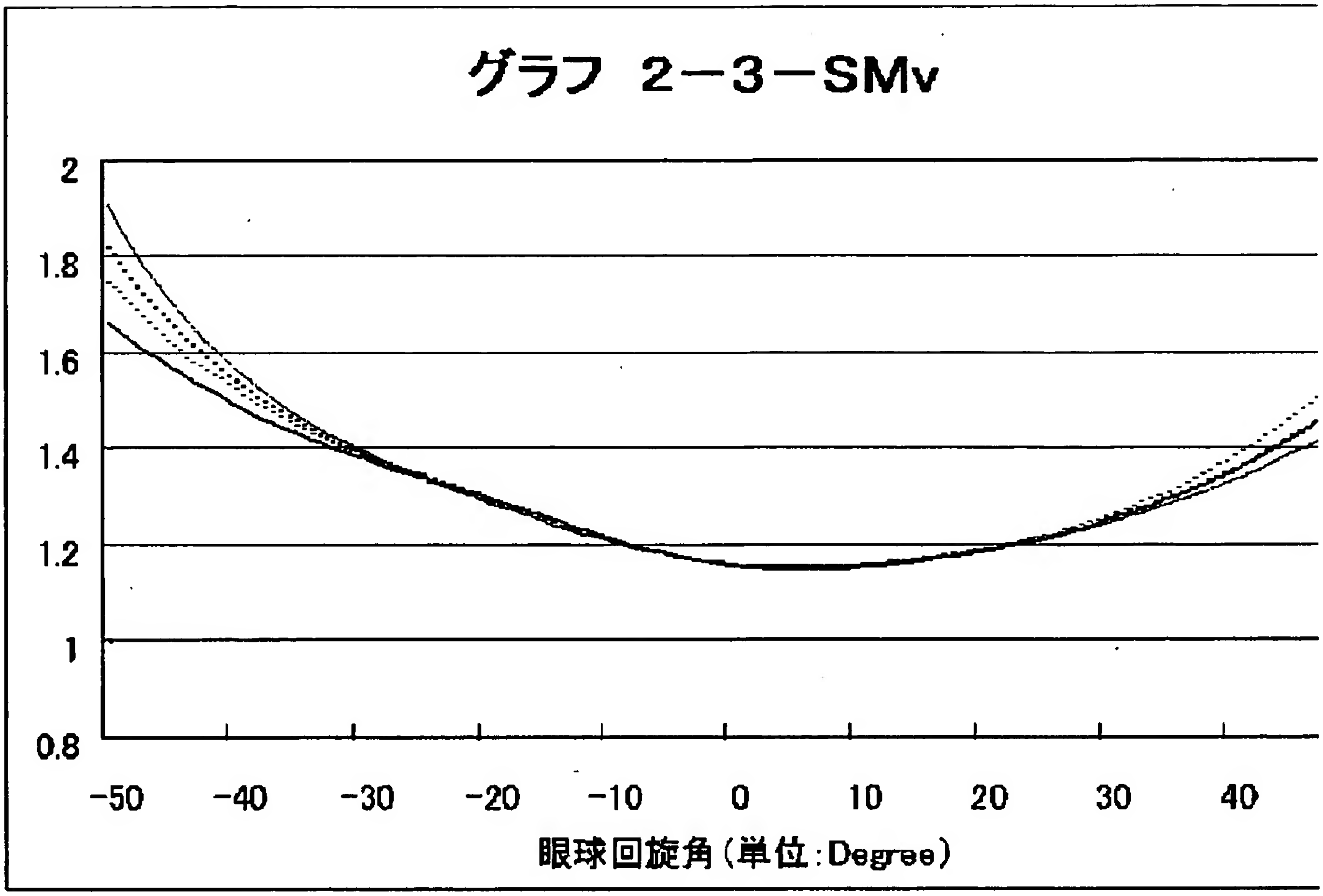
[Procedure amendment 15]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 27
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 27]



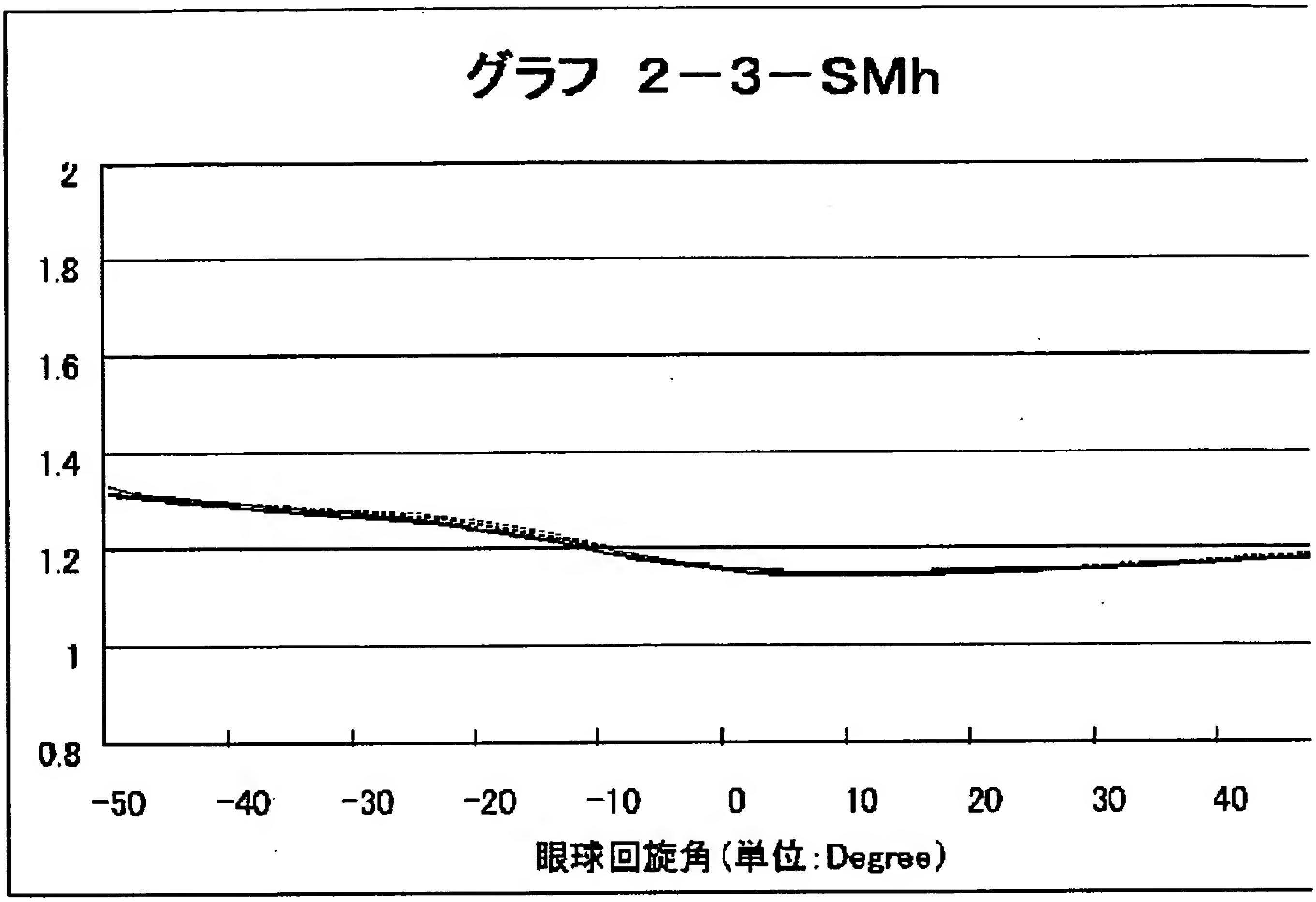
[Procedure amendment 16]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 28
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 28]



[Procedure amendment 17]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 29
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 29]



[Procedure amendment 18]
[Document to be Amended] DRAWINGS
[Item(s) to be Amended] drawing 30
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 30]



[Procedure amendment 19]
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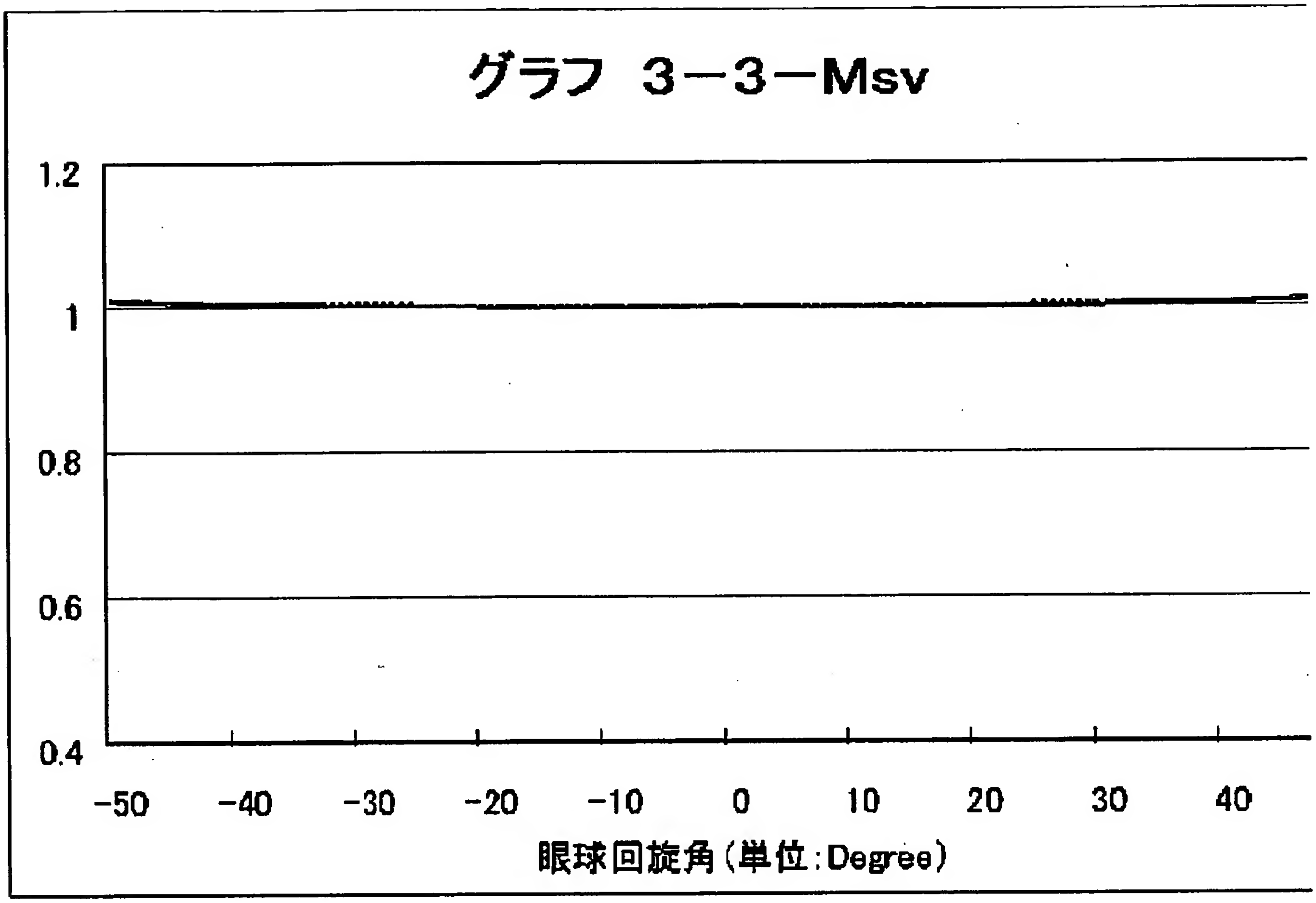
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 31]



[Procedure amendment 20]
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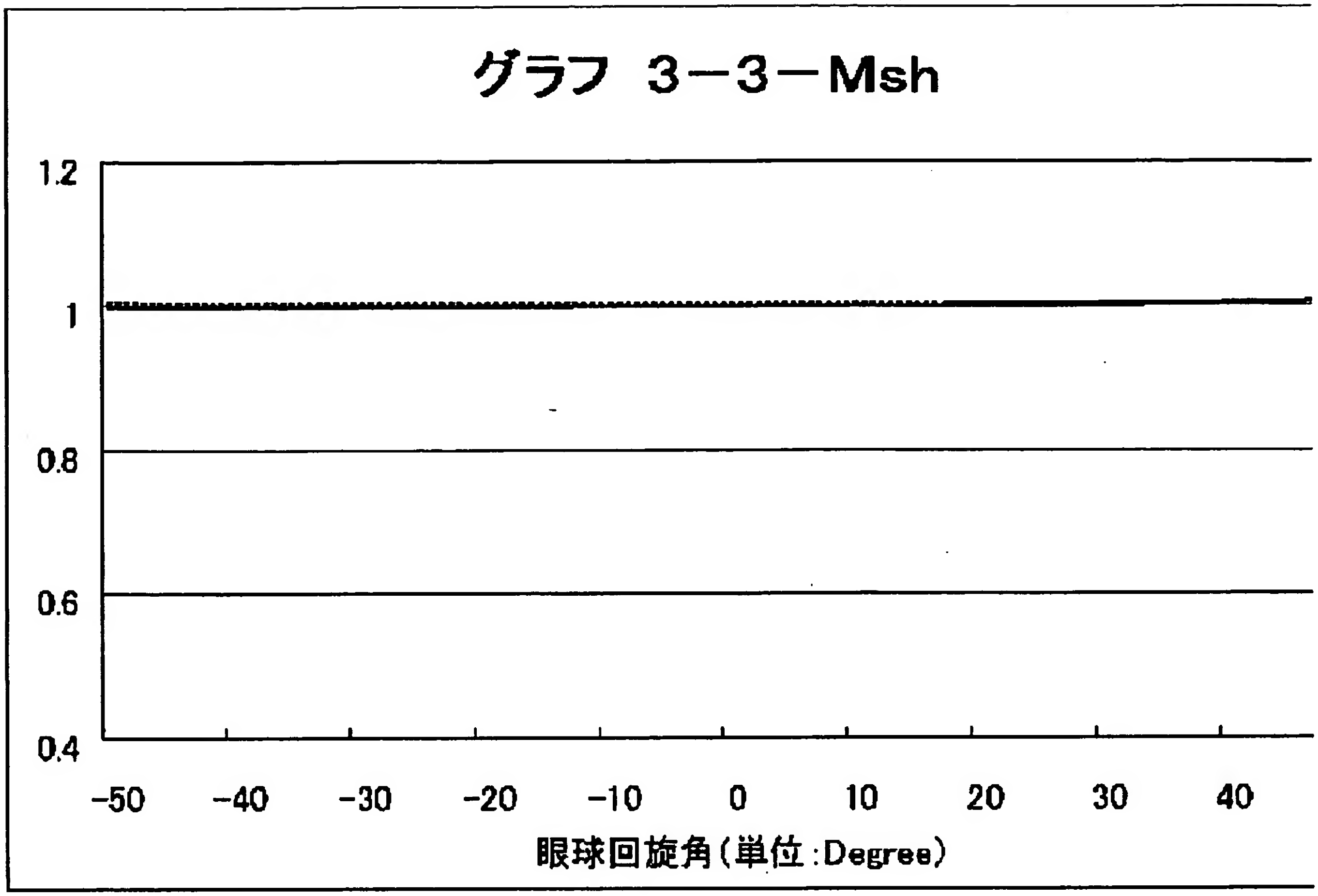
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 32]



[Procedure amendment 21]
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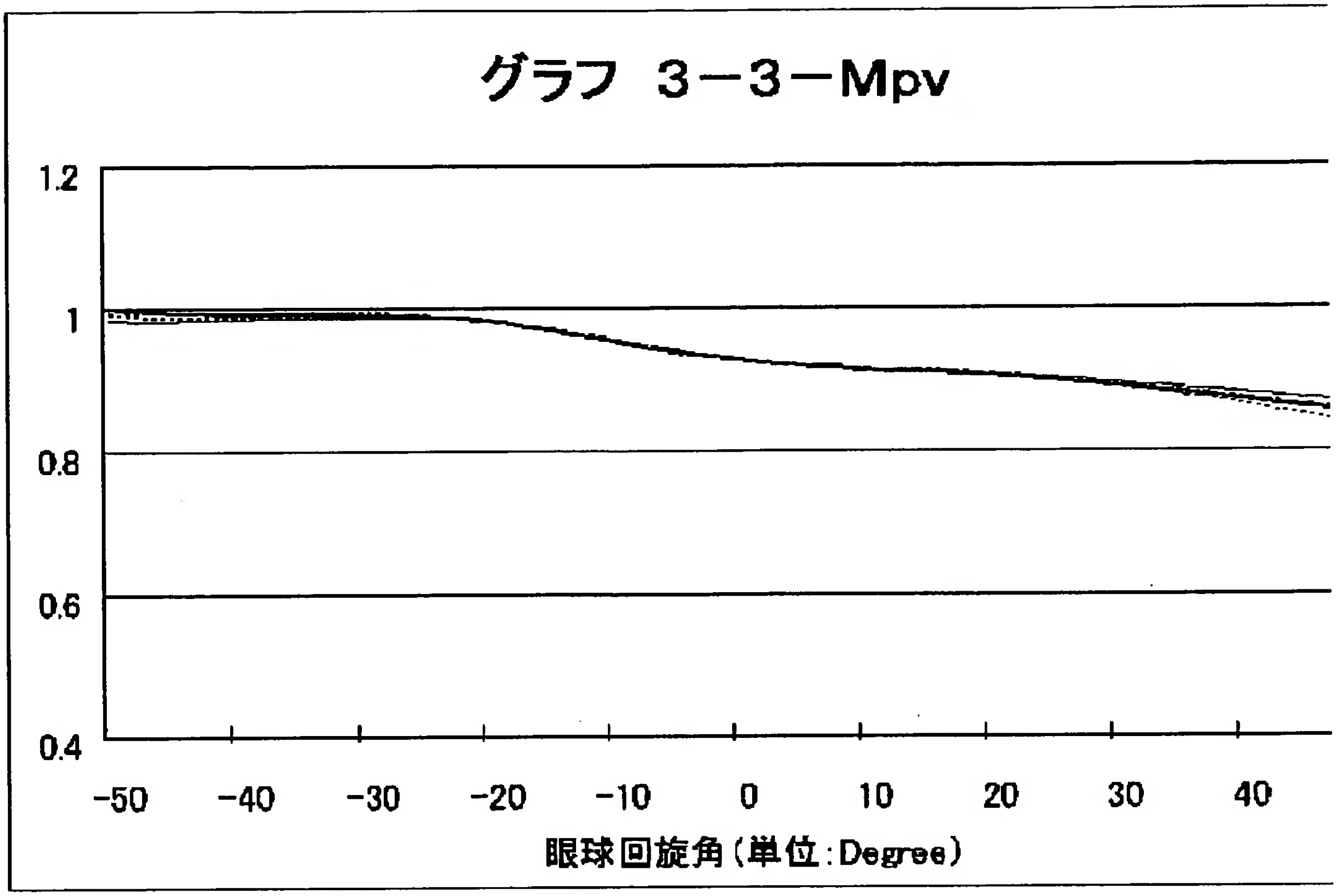
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 33]



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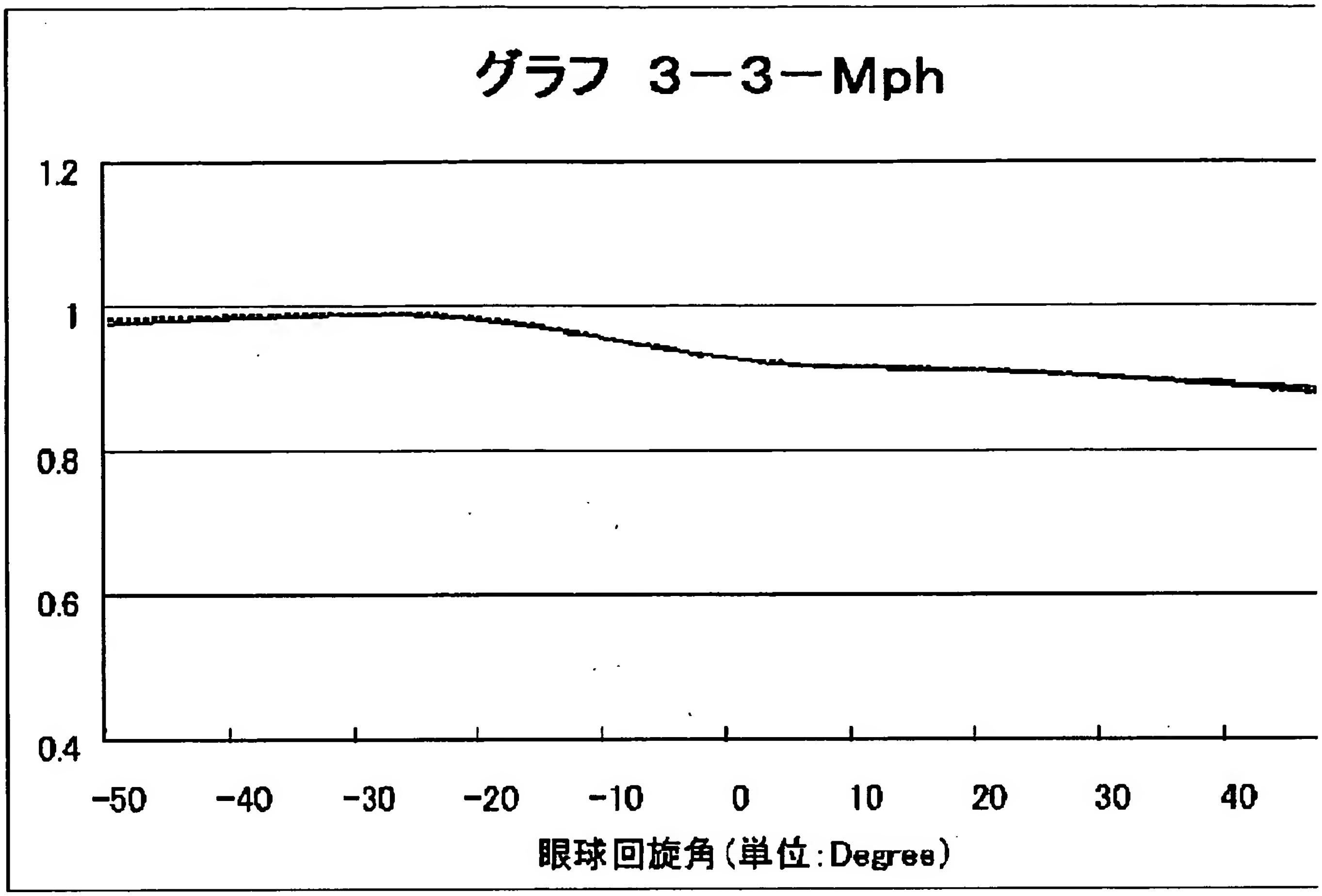
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 34]



[Procedure amendment 23]
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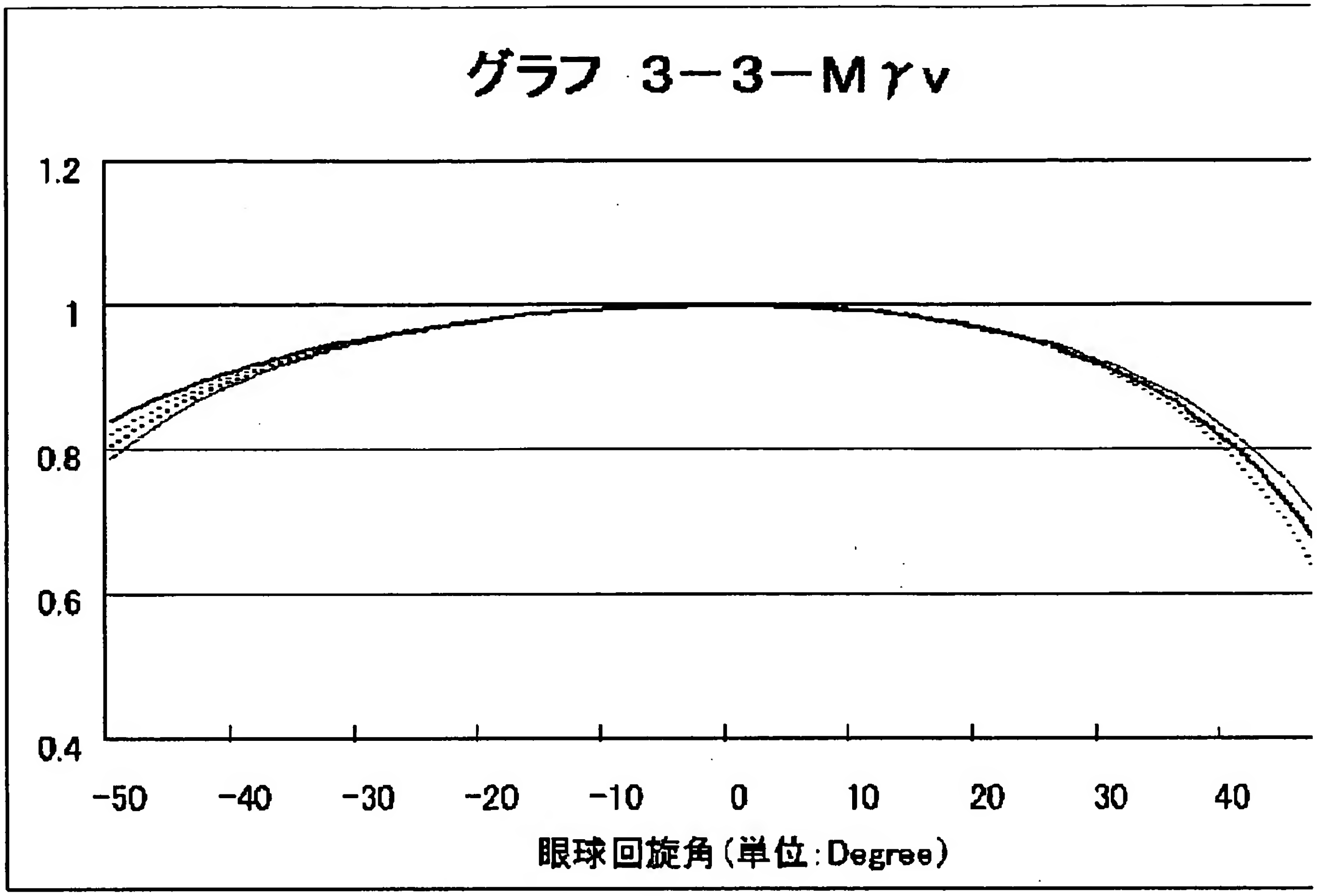
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 35]



[Procedure amendment 24]
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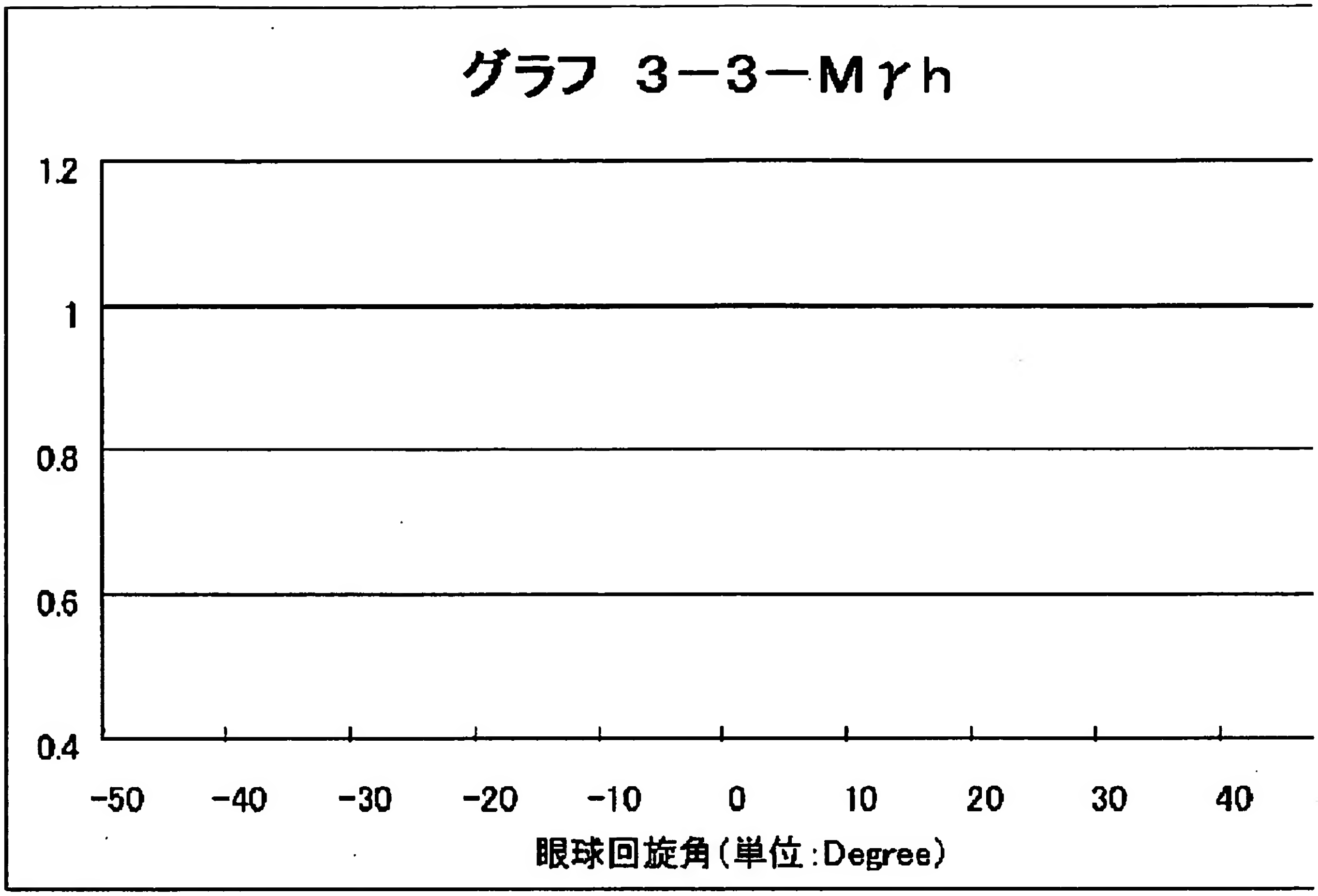
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 36]



[Procedure amendment 25]
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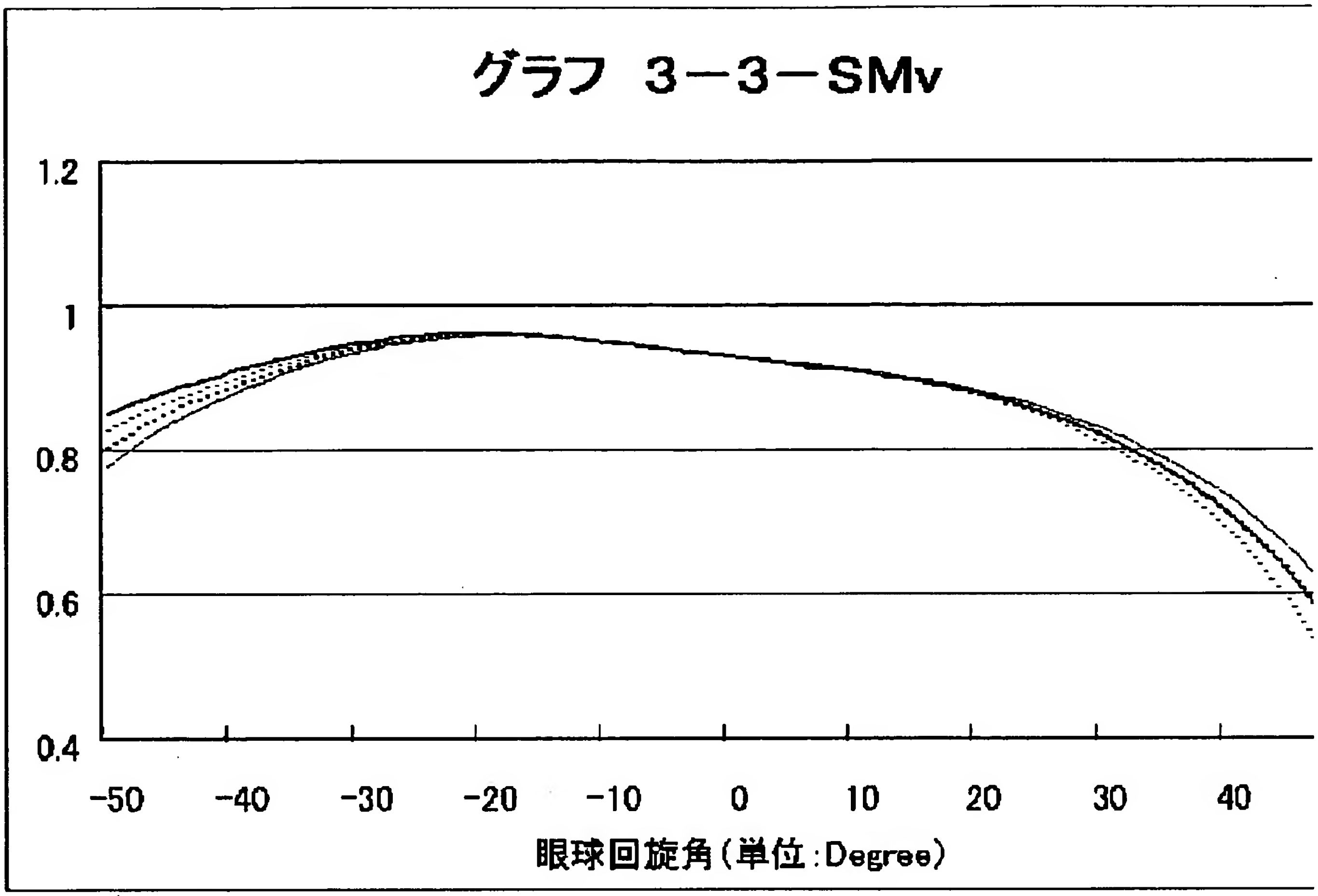
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 37]



[Procedure amendment 26]
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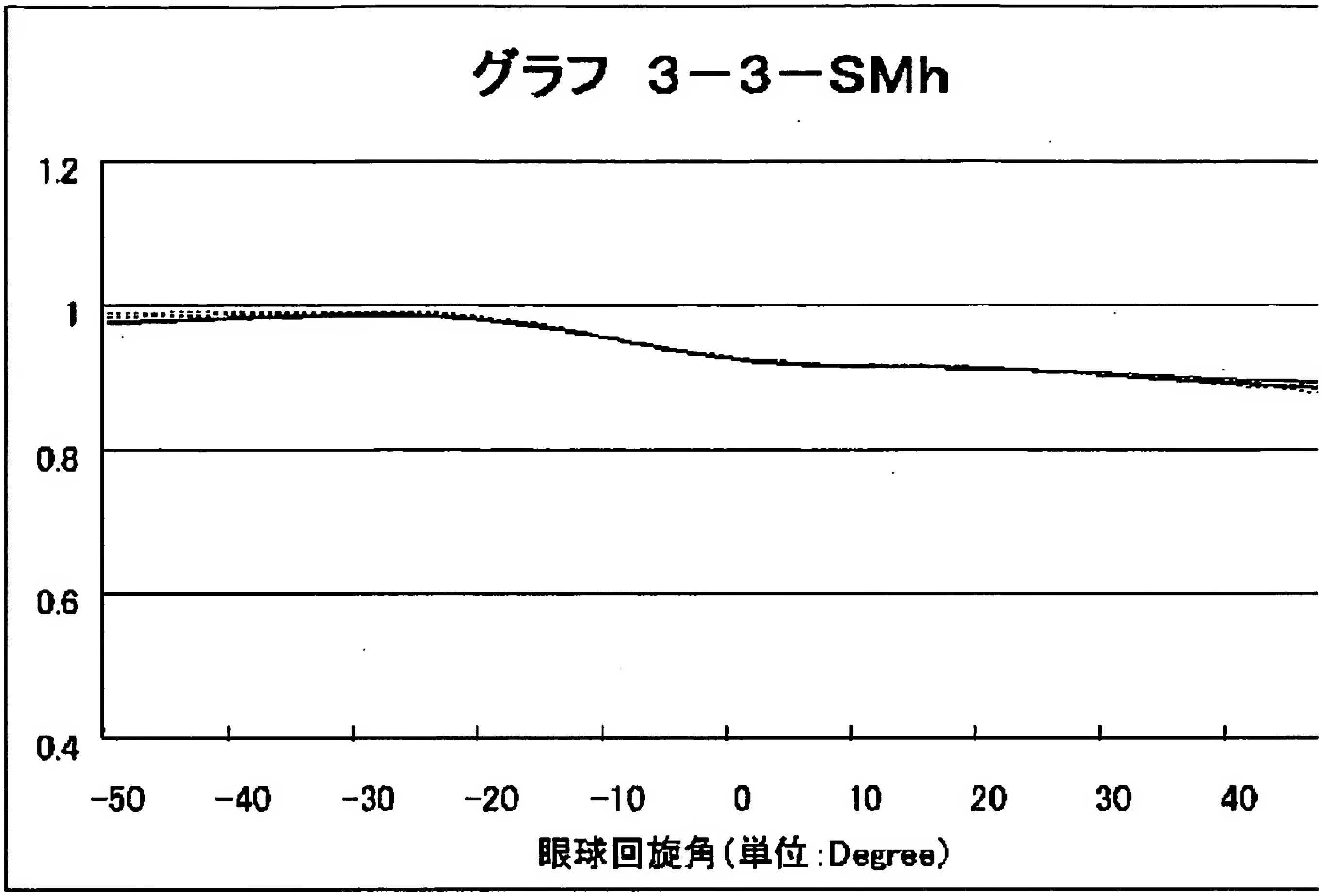
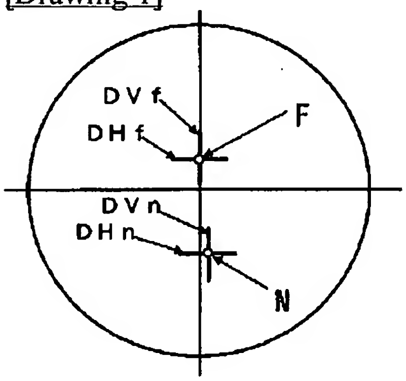
[Method of Amendment] Modification
[Proposed Amendment]
[Drawing 38]



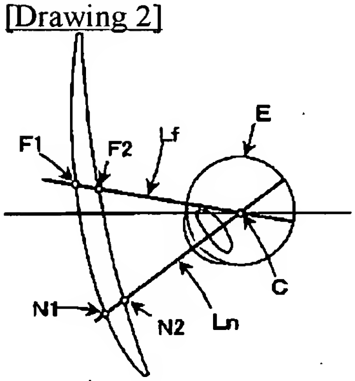
[Translation done.]

DRAWINGS

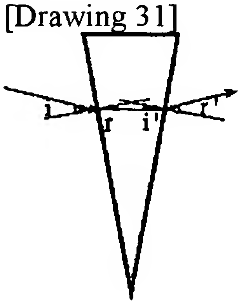
[Drawing 1]



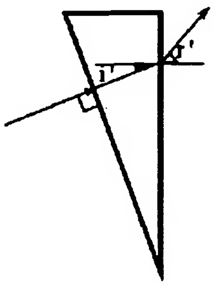
[Drawing 2]



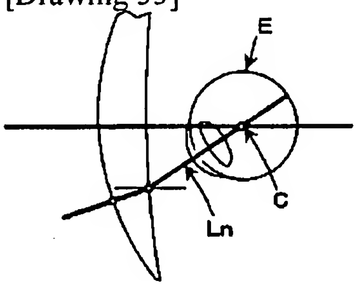
[Drawing 31]



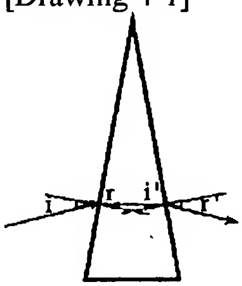
[Drawing 32]



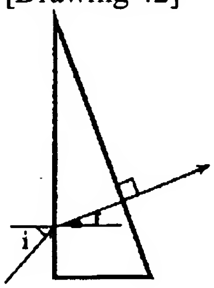
[Drawing 33]



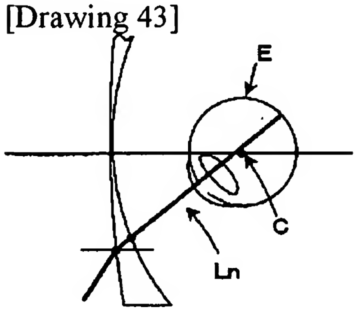
[Drawing 4-1]



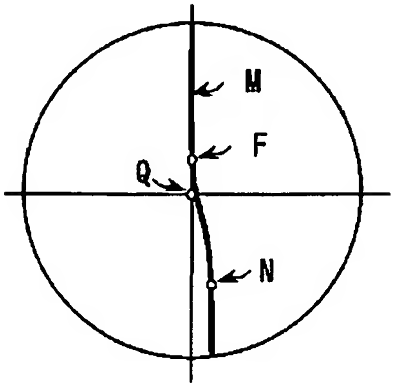
[Drawing 42]



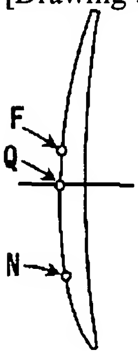
[Drawing 43]



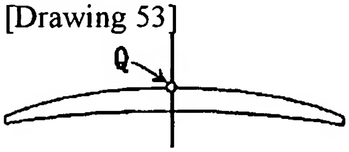
[Drawing 5-1]



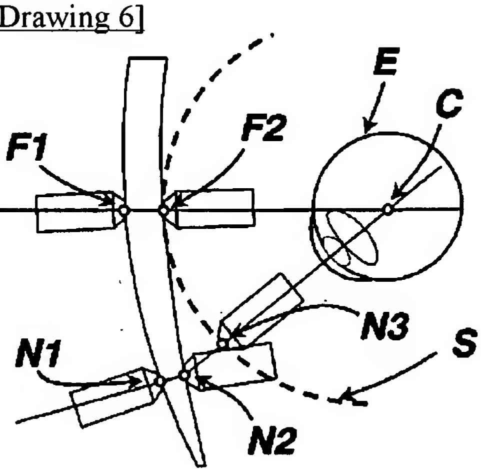
[Drawing 52]



[Drawing 53]



[Drawing 6]



[Drawing 7]

表1−1	DVf1	DHf1	DVn1	DHn1	DVf2	DHf2	DVn2	DHn2
従来技術例A(凸面累進)	4.00	4.00	7.00	7.00	4.00	4.00	4.00	4.00
従来技術例B(両面累進)	4.75	4.75	6.25	6.25	4.75	4.75	3.25	3.25
従来技術例C(凹面累進)	5.50	5.50	5.50	5.50	5.50	5.50	2.50	2.50
実施例 1	4.75	4.75	7.75	4.75	4.75	4.75	4.75	1.75
実施例 4	5.50	4.00	8.50	4.00	5.50	4.00	5.50	1.00
実施例 5	6.25	6.25	6.25	3.25	6.25	6.25	3.25	0.25
実施例 6	6.50	4.50	6.50	4.50	6.50	4.50	3.50	1.50

表1−2	SMVf	SMVn	SMVfn	SMHf	SMHn	SMHfn
従来技術例A(凸面累進)	1.0087	1.1467	0.1380	1.0077	1.1092	0.1015
従来技術例B(両面累進)	1.0104	1.1464	0.1360	1.0092	1.1080	0.0988
従来技術例C(凹面累進)	1.0120	1.1462	0.1342	1.0107	1.1068	0.0961
実施例 1	1.0104	1.1446	0.1342	1.0092	1.1046	0.0954
実施例 4	1.0120	1.1428	0.1308	1.0076	1.1028	0.0952
実施例 5	1.0137	1.1438	0.1301	1.0123	1.1024	0.0901
実施例 6	1.0143	1.1431	0.1288	1.0086	1.1042	0.0956

[Drawing 8]

表2−1	DVf1	DHf1	DVn1	DHn1	DVf2	DHf2	DVn2	DHn2
従来技術例A(凸面累進)	9.00	9.00	12.00	12.00	3.00	3.00	3.00	3.00
従来技術例B(両面累進)	9.75	9.75	11.25	11.25	3.75	3.75	2.25	2.25
従来技術例C(凹面累進)	10.50	10.50	10.50	10.50	4.50	4.50	1.50	1.50
実施例 2	9.75	9.75	12.75	9.75	3.75	3.75	3.75	0.75
実施例 7	9.00	9.00	15.00	9.00	3.00	3.00	6.00	0.00

表2−2	SMVf	SMVn	SMVfn	SMHf	SMHn	SMHfn
従来技術例A(凸面累進)	1.1661	1.3936	0.2275	1.1452	1.2777	0.1325
従来技術例B(両面累進)	1.1684	1.3961	0.2277	1.1487	1.2755	0.1268
従来技術例C(凹面累進)	1.1709	1.3989	0.2280	1.1523	1.2733	0.1210
実施例 2	1.1683	1.3834	0.2151	1.1486	1.2685	0.1199
実施例 7	1.1658	1.3724	0.2066	1.1451	1.2639	0.1188

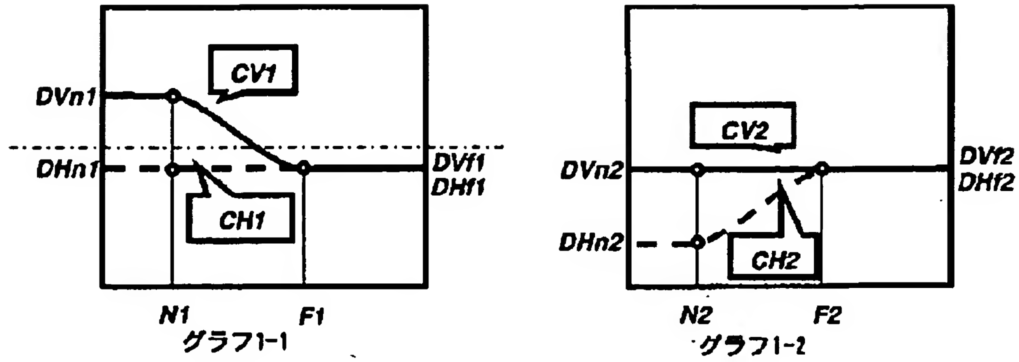
[Drawing 9]

表3−1	DVf1	DHf1	DVn1	DHn1	DVf2	DHf2	DVn2	DHn2
従来技術例A(凸面累進)	1.00	1.00	4.00	4.00	7.00	7.00	7.00	7.00
従来技術例B(両面累進)	1.75	1.75	3.25	3.25	7.75	7.75	6.25	6.25
従来技術例C(凹面累進)	2.50	2.50	2.50	2.50	8.50	8.50	5.50	5.50
実施例 3	1.75	1.75	4.75	1.75	7.75	7.75	7.75	4.75

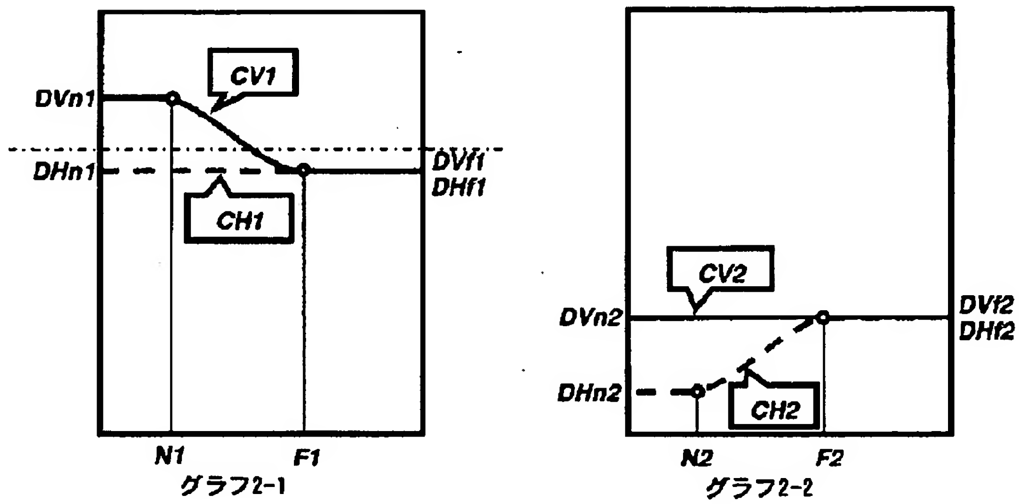
表3−2	SMVf	SMVn	SMVfn	SMHf	SMHn	SMHfn
従来技術例A(凸面累進)	0.8953	0.9428	0.0475	0.9140	0.9914	0.0774
従来技術例B(両面累進)	0.8973	0.9391	0.0418	0.9149	0.9899	0.0750
従来技術例C(凹面累進)	0.8991	0.9354	0.0363	0.9157	0.9884	0.0727
実施例 3	0.8973	0.9485	0.0512	0.9149	0.9875	0.0726

[Drawing 10]

実施例 1

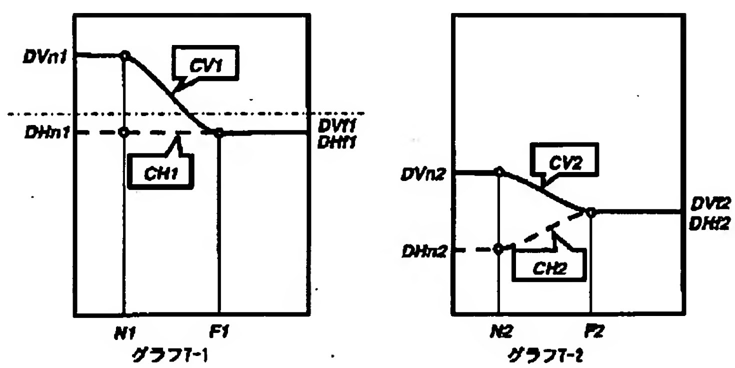


実施例 2

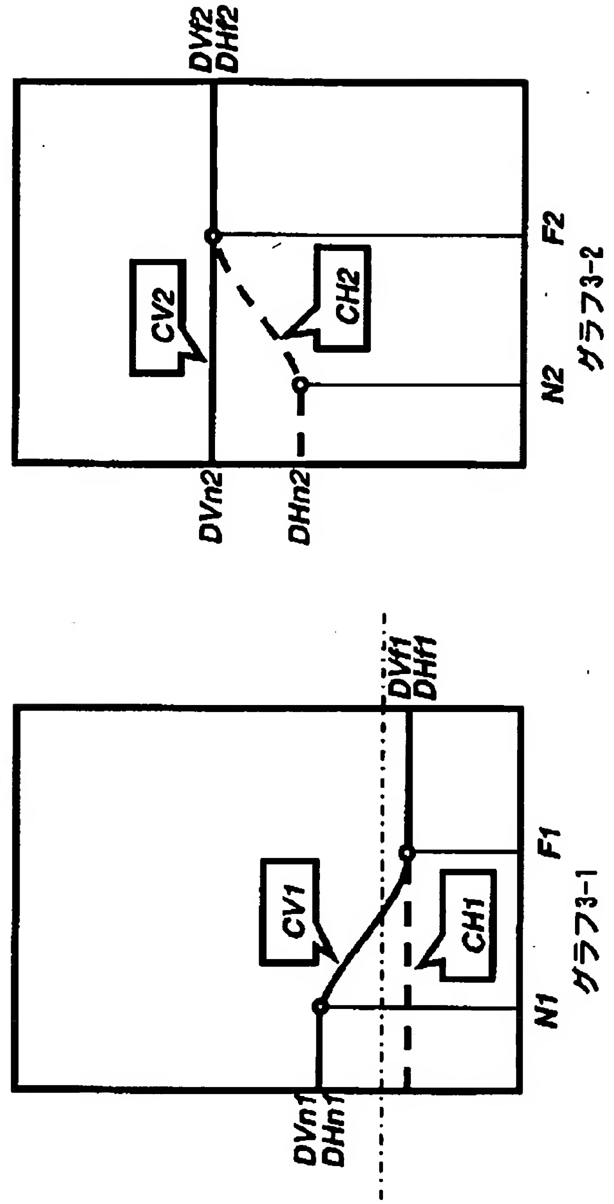


[Drawing 13]

実施例 7

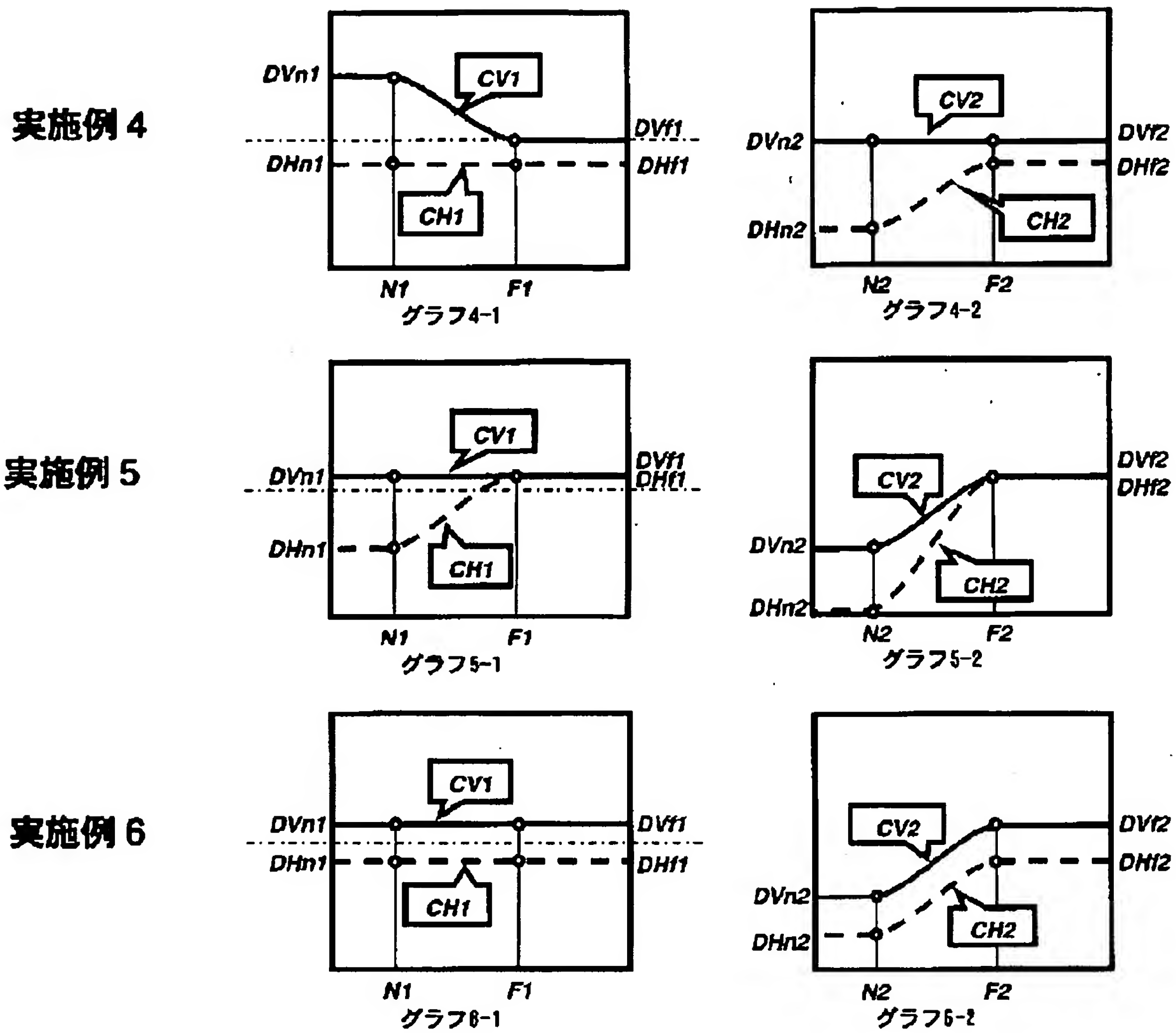


[Drawing 11]



実施例3

[Drawing 12]



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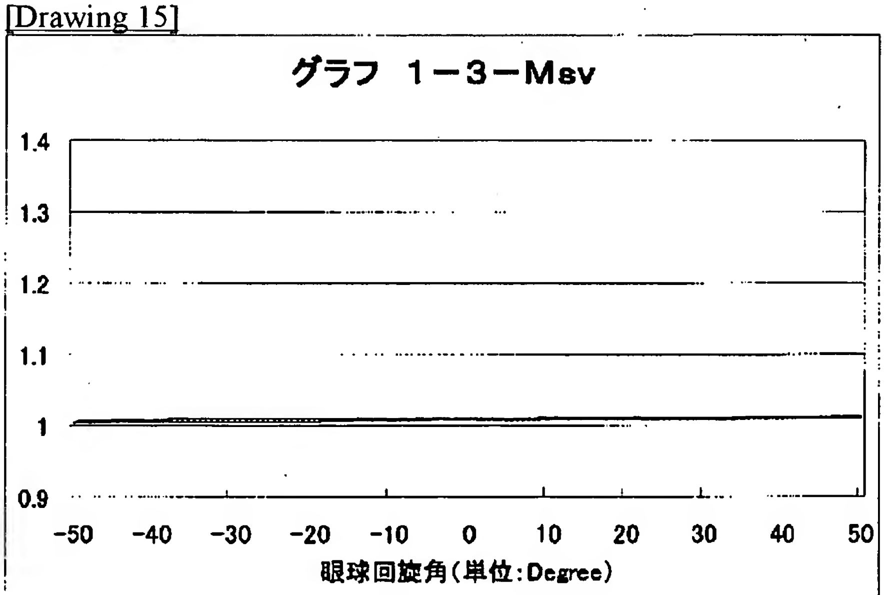
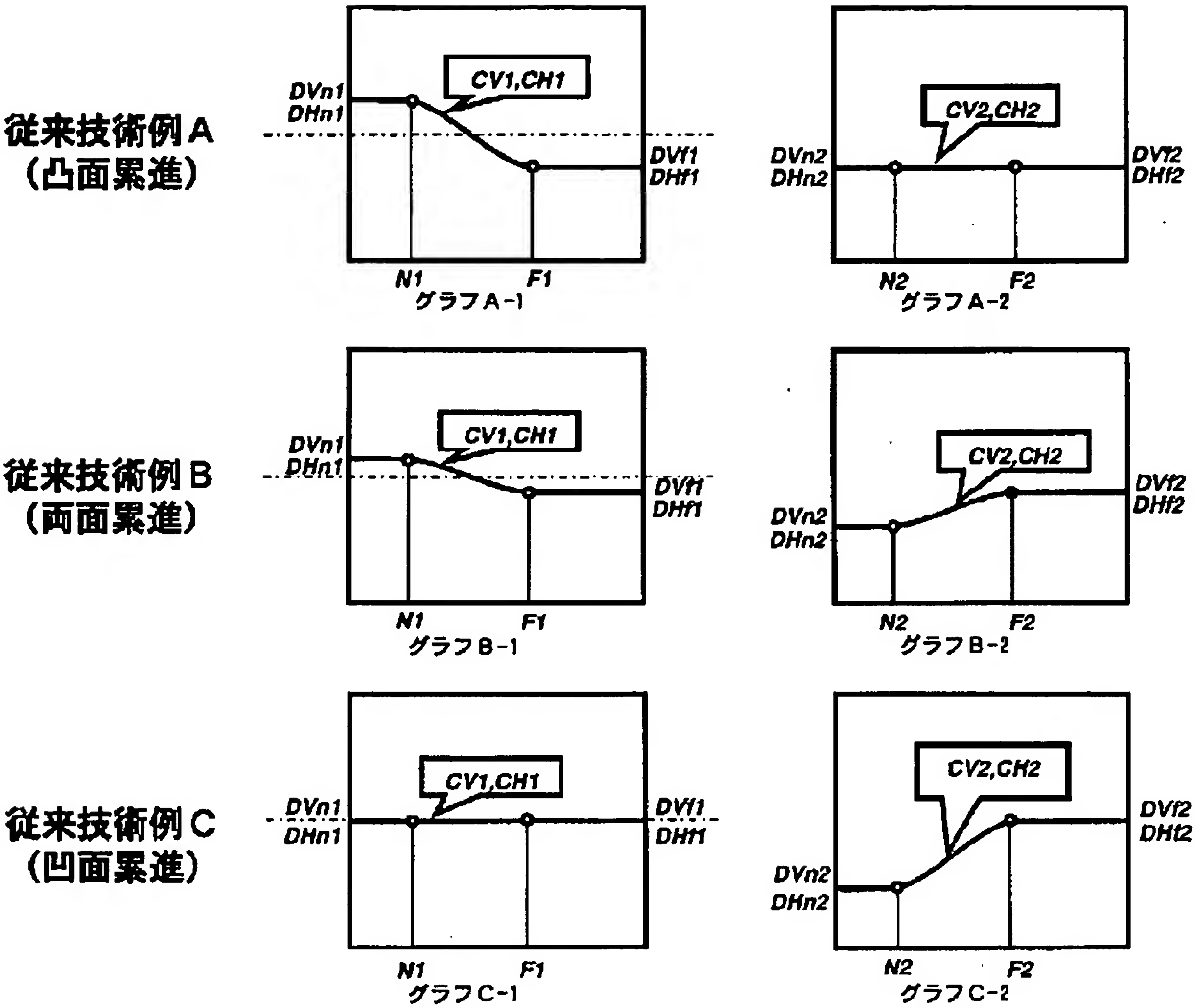
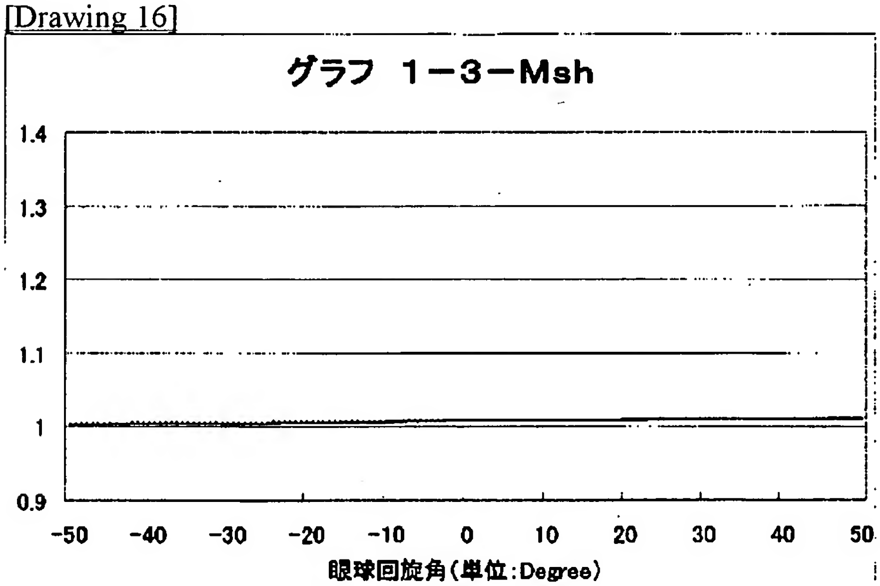


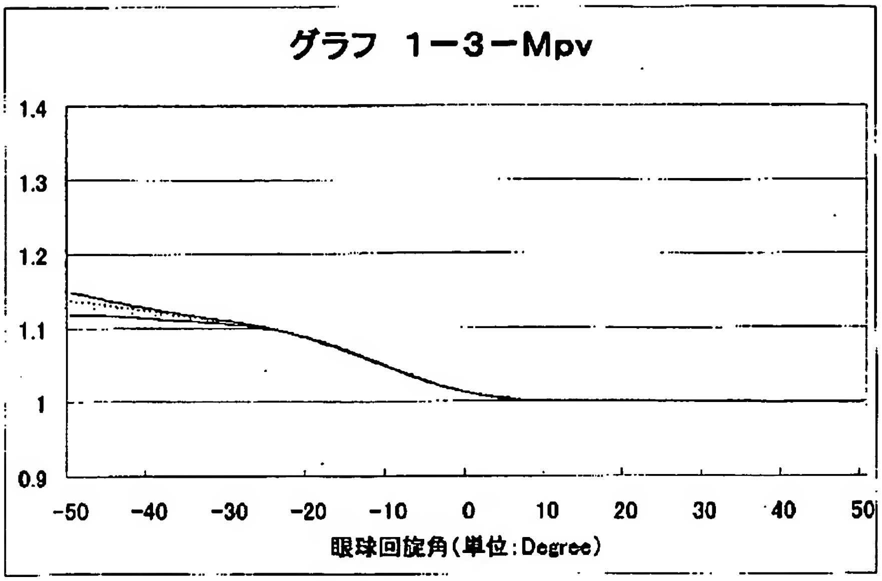
[Drawing 14]



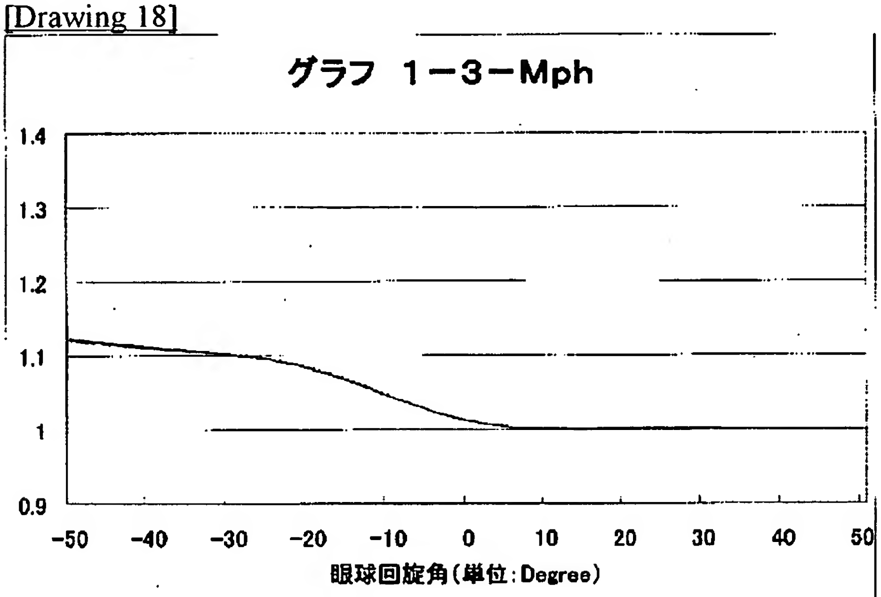
[Drawing 16]



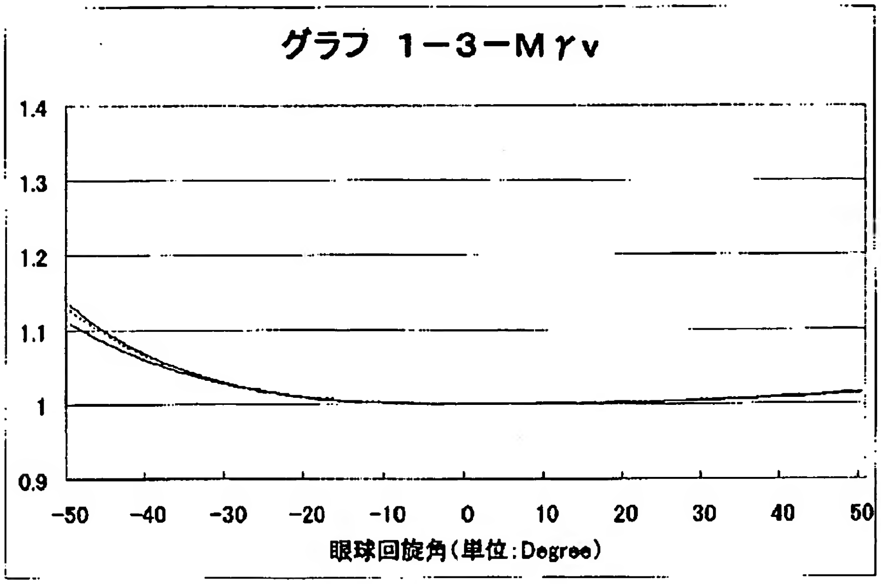
[Drawing 17]



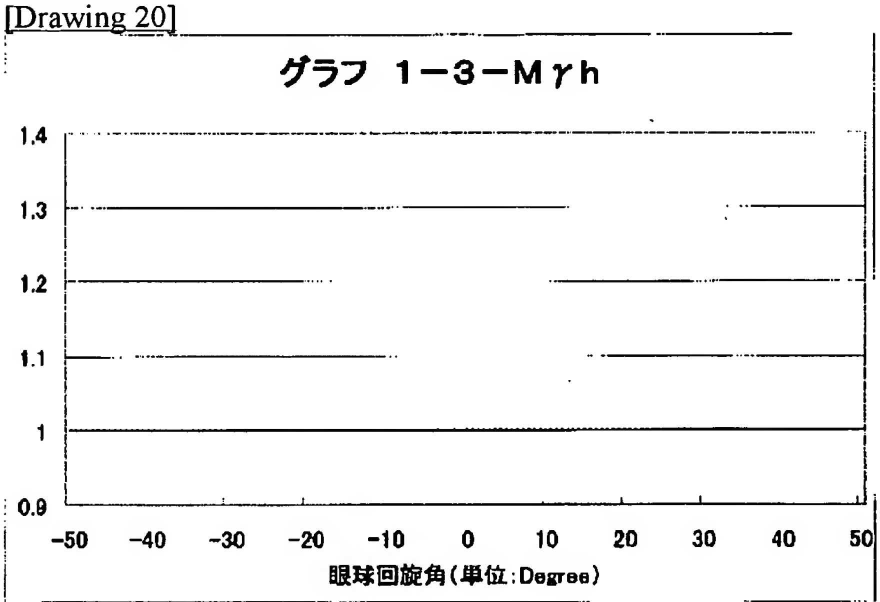
[Drawing 18]



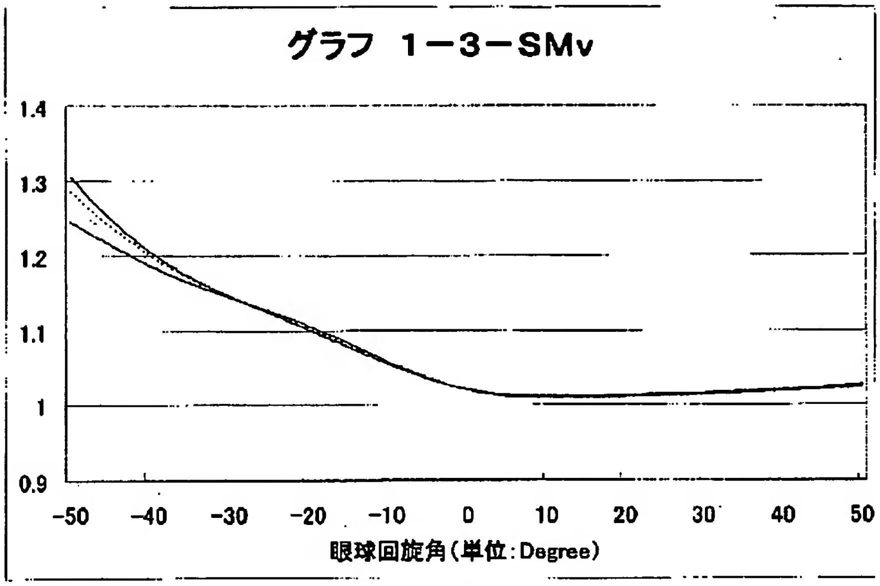
[Drawing 19]



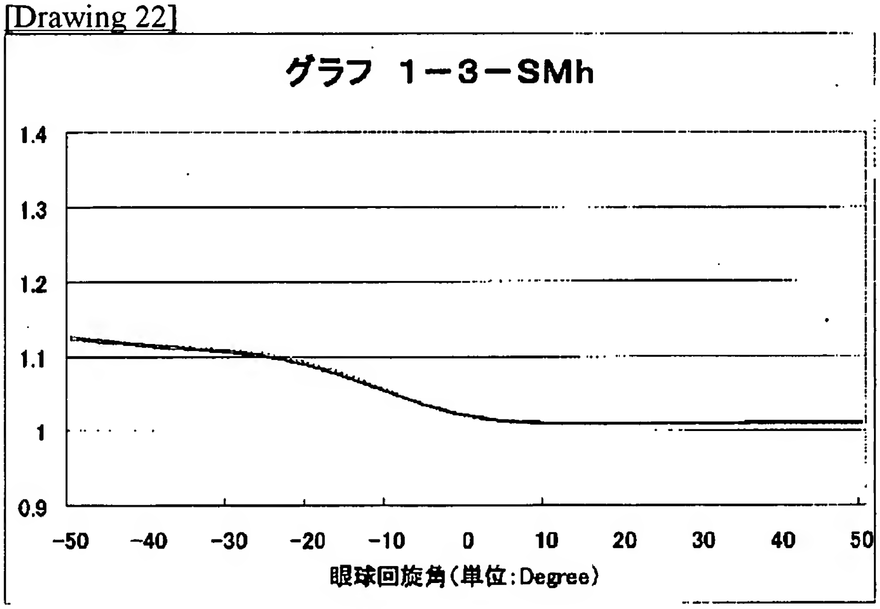
[Drawing 20]



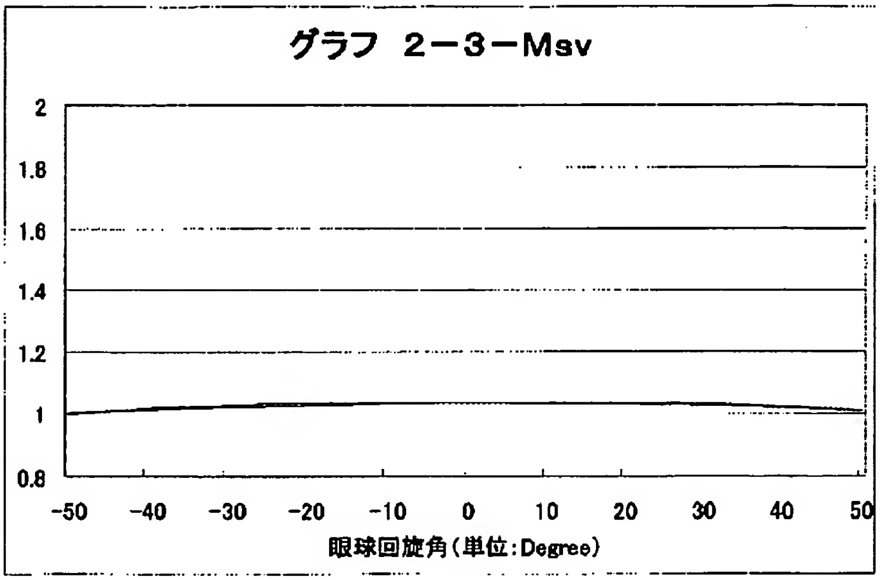
[Drawing 21]



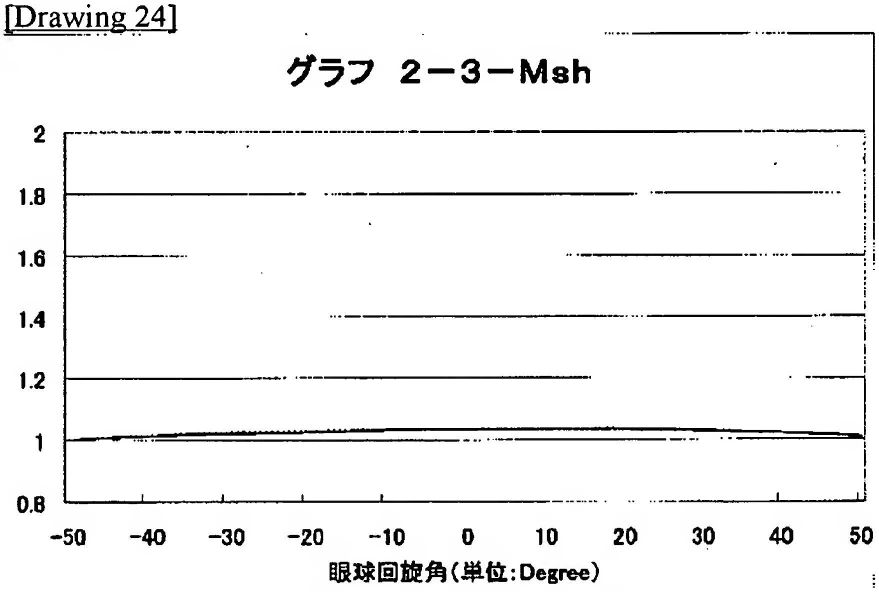
[Drawing 22]



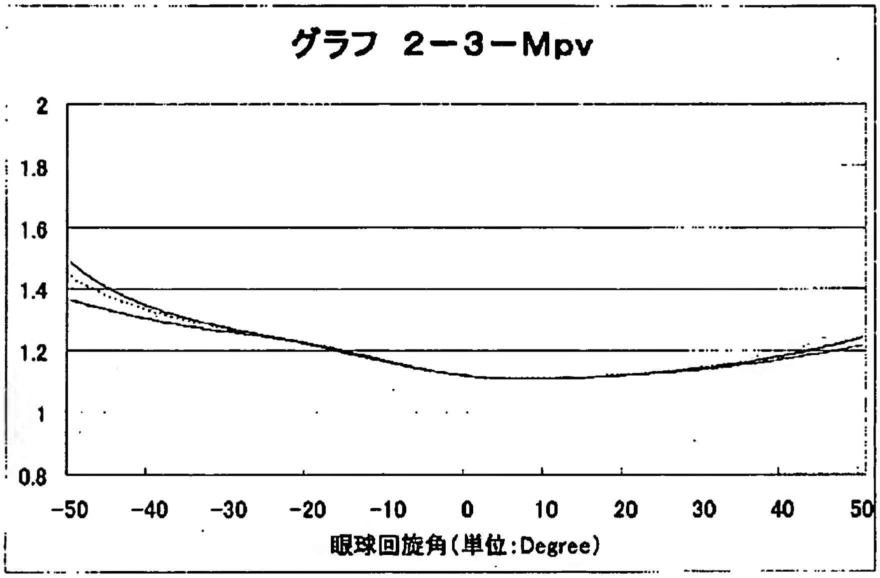
[Drawing 23]



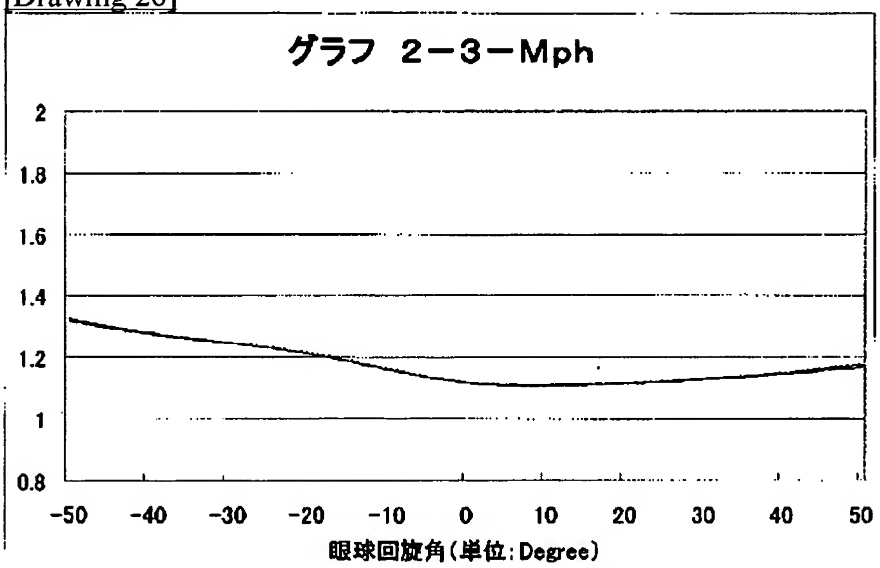
[Drawing 24]



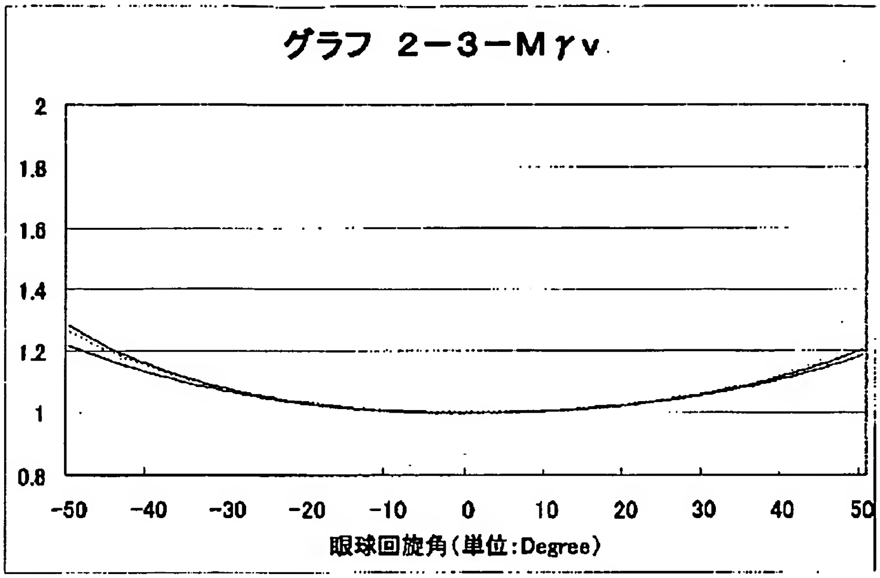
[Drawing 25]



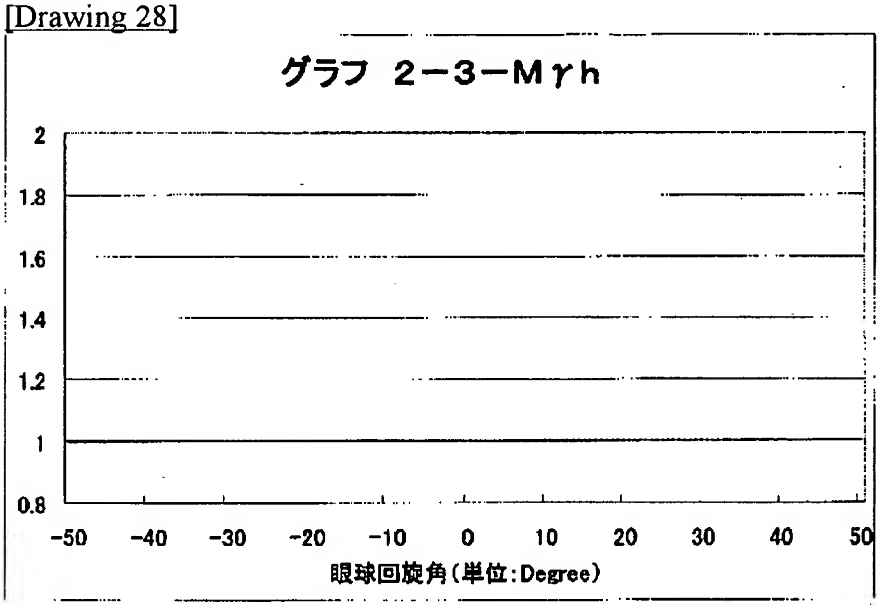
[Drawing 26]



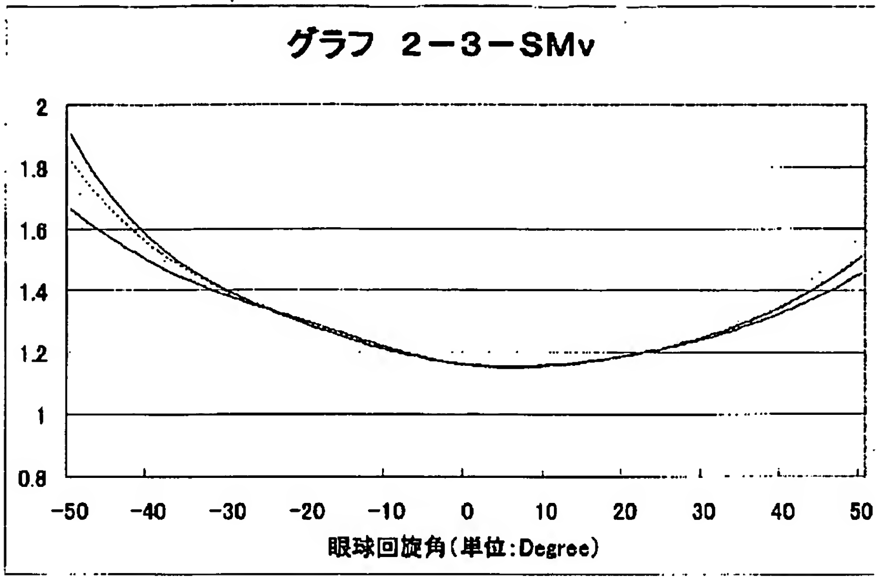
[Drawing 27]



[Drawing 28]



[Drawing 29]



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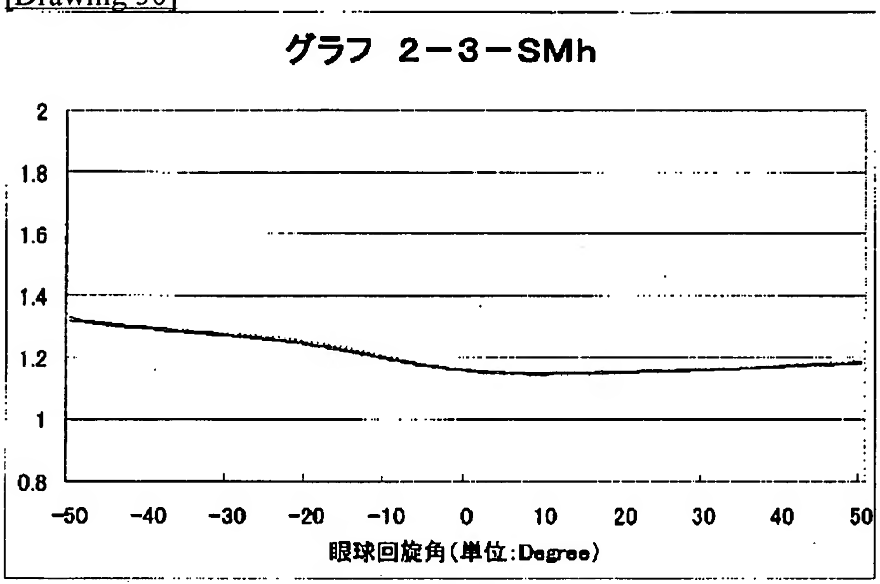

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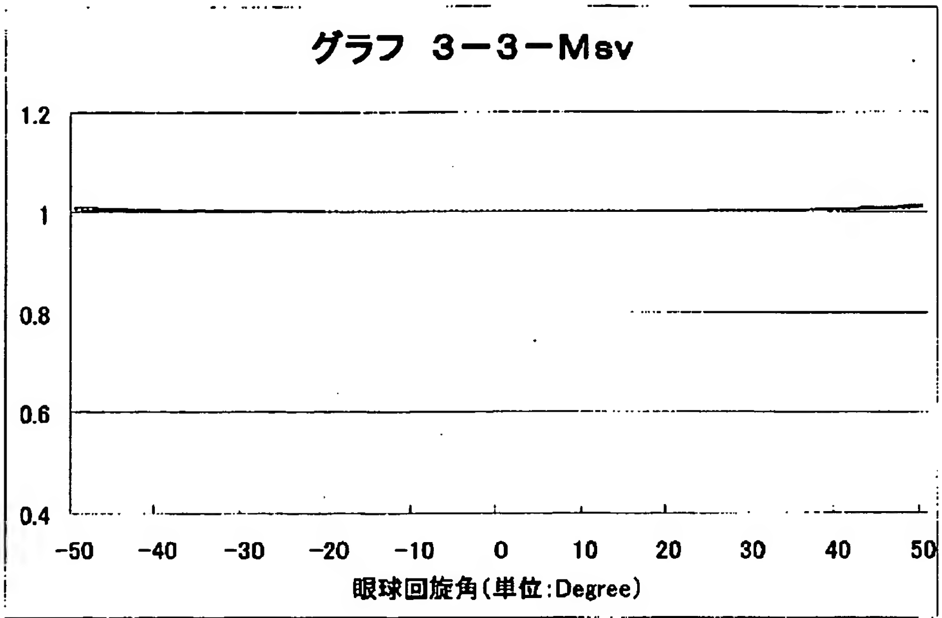

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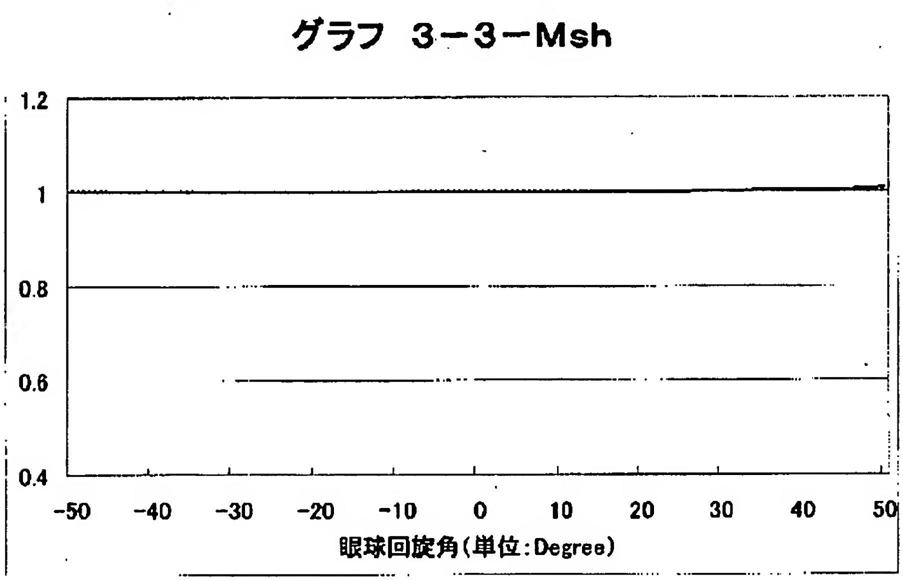
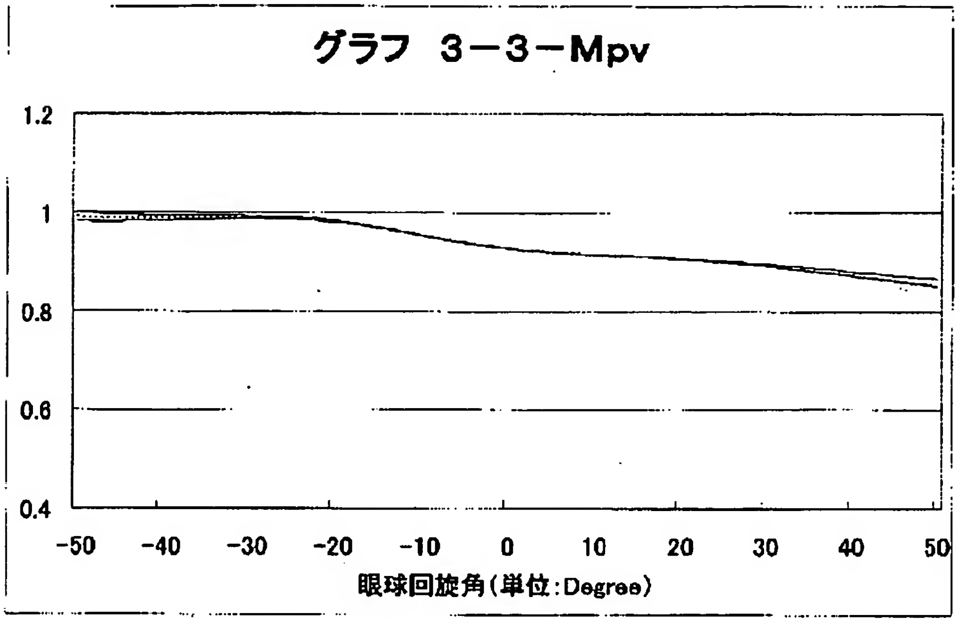
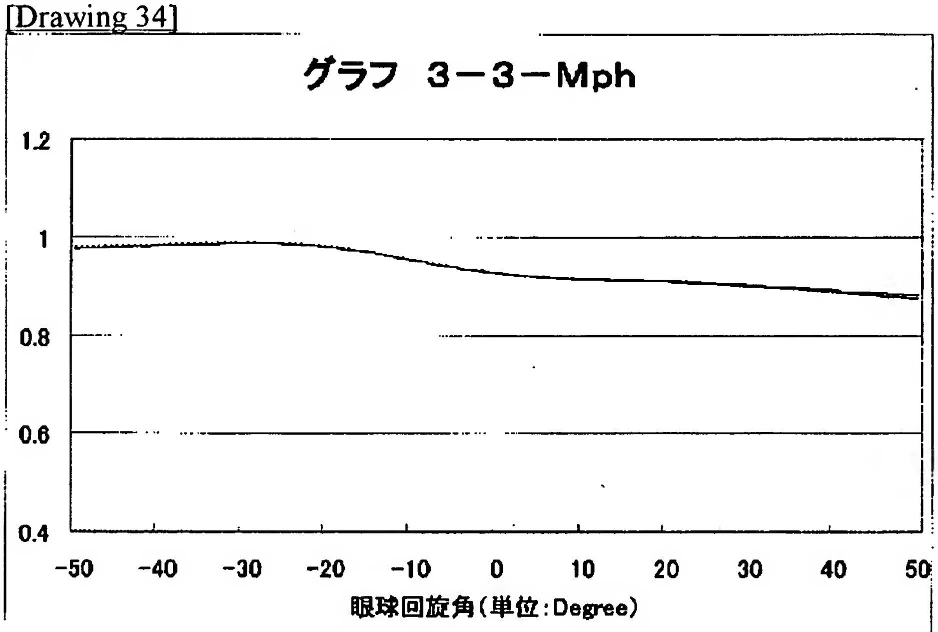


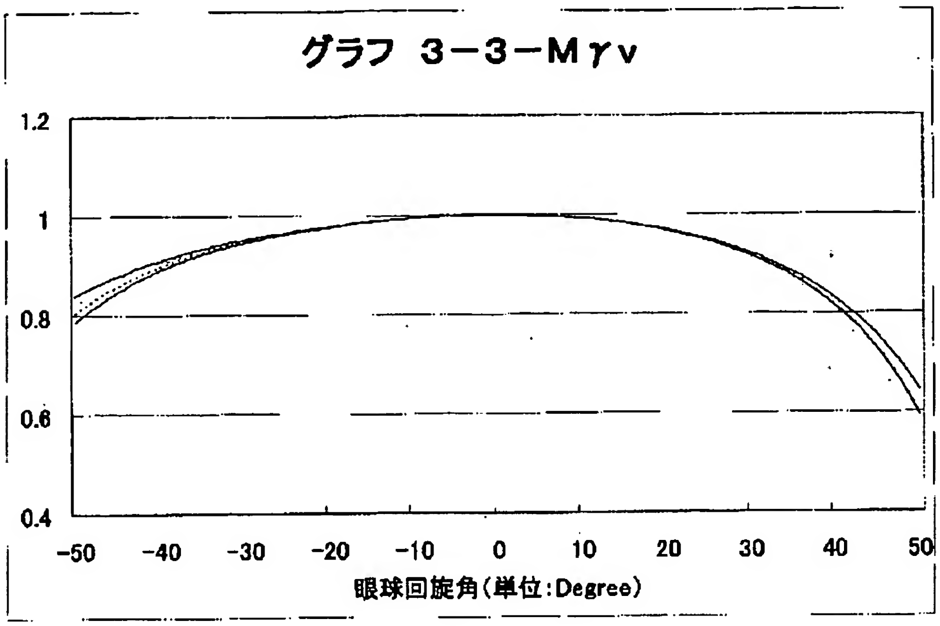
[Drawing 33]



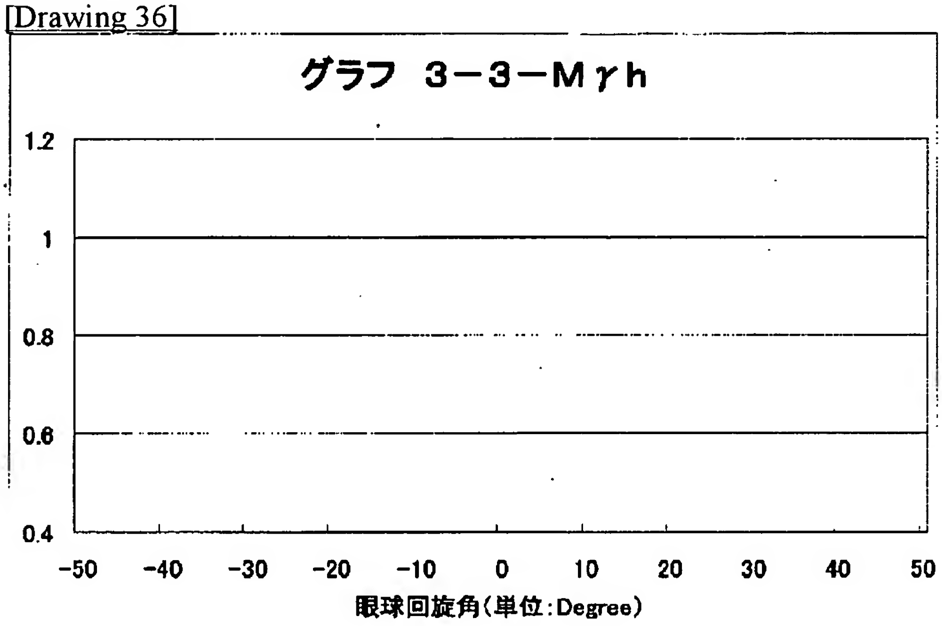
[Drawing 34]



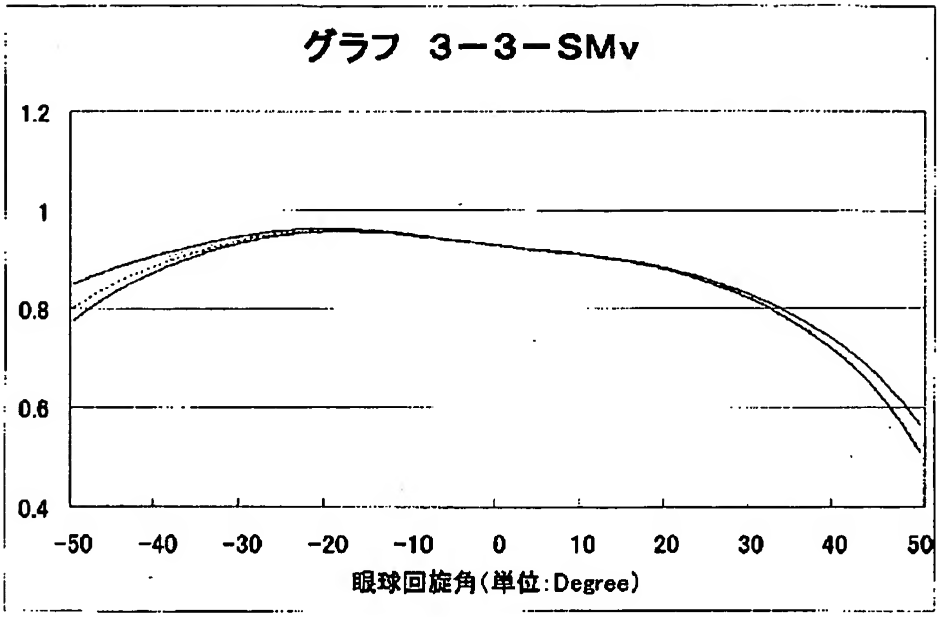
[Drawing 35]



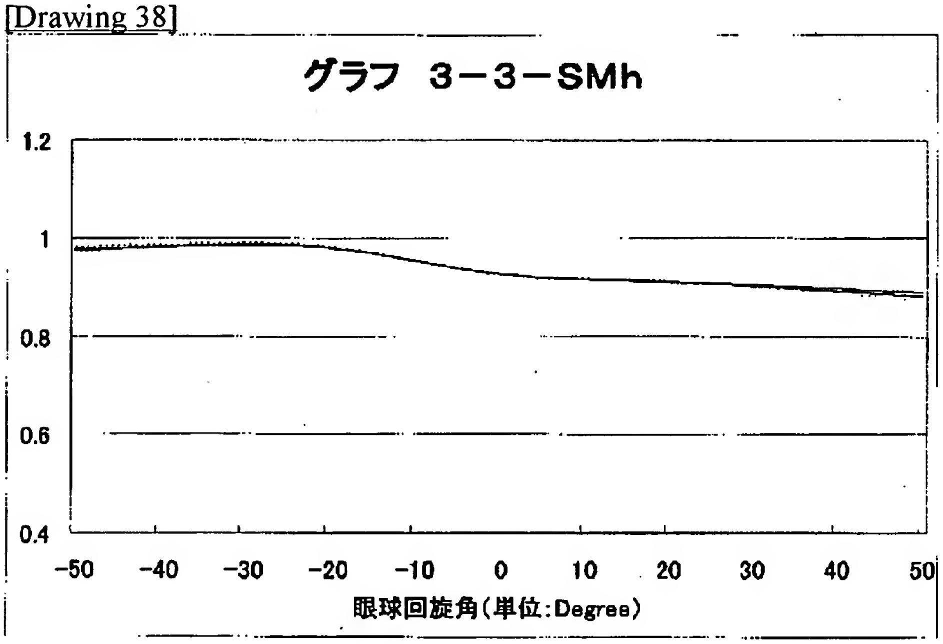
[Drawing 36]



[Drawing 37]



[Drawing 38]



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